

LIBRARY
OF THE
UNIVERSITY OF CALIFORNIA.

GIFT OF

Duncan Mc Duffie

Class

Mc Duffie





Digitized by the Internet Archive
in 2007 with funding from
Microsoft Corporation

THE
FACTORY MANAGER
AND
ACCOUNTANT

SOME EXAMPLES OF THE LATEST
AMERICAN FACTORY PRACTICE

Collected and Arranged by
HORACE LUCIAN ARNOLD
(*Henry Roland*)

The Highest Labor-Hour Production is the Highest Human Good.

—ARNOLD.



NEW YORK AND LONDON
THE ENGINEERING MAGAZINE

1903

HF5686
.M3A85

Dept - of
S. Mc Duffie
MCC

Copyright, 1903,

BY

JOHN R. DUNLAP.

Entered at Stationers' Hall, London.

PREFACE.

This book is made up of several complete systems of factory-accounting forms, both the costing and the commercial blanks being accurately reproduced in arrangement, and each one having the actual size in inches given, together with its color and the material on which it is printed. The function and the exact manner of using each form are also carefully and fully detailed, so that the reader can easily comprehend its scope and employment, and make an intelligent estimate of its probable value if applied to his own uses.

The commercial and the costing accounting systems are so closely related in the best modern factory practice that neither can be fully and entirely comprehended without a knowledge of the other, and in some instances the same single form is used by both the cost-keeper and the commercial accountant, so that it cannot be fully described without reference to both functions.

The reader is thus enabled to reproduce any form here shown, and apply it in his own practice, and he may also trace its action and effects in relation to the entire accounting of the factory, and can compare his own practice with that of other managers, cost-keepers or accountants.

The experienced and successful factory manager is fully aware of the importance of adapting each form blank perfectly to its intended uses, and well knows the tedious and costly experiments which invariably precede that final perfecting of a form before its record of dates and procedures can be made with the least possible

clerical labor, while giving the best and clearest summary of performance; and managers who are satisfied with their own methods and results will study with deep interest the means employed by others to obtain similar effects.

The manager who is not perfectly satisfied with his system, and who is aware that his accounting costs more than it should, and fails to give information in such complete detail as to clearly point the way to highly desirable savings which he believes possible, will find in the following pages information and examples of great value, showing the exact means by which others have reached the ends he himself wishes to attain.

CONTENTS.

CHAPTER I.

FACTORY ROUTINE, ORGANIZATION AND COST-FINDING..... I

System and Order—The Highest Labor-Hour Production Is the Highest Human Good—Reasons for Organization—The Highly Organized Factory—The True Object of Cost-Finding—The Ideal Factory.

CHAPTER II.

ADVANCES IN FACTORY ACCOUNTING..... 12

Importance of Cost-Finding—The Interdependence of Manufacturers—Manufacturers Should Exhibit Their Practice—The Factory Manager's Best Informant—Improved Factory Management—Many Simple Aids Preferred to Fewer Complex Forms—Economic Functions of Cost-Finding—States and Nations are Labor Products—Entire and Partial Manufacture—The Specialized Factor—The Necessity for Cost Reduction—Labor Costs the Principal Factor of Advancement.

CHAPTER III.

COST-FINDING SYSTEM OF THE LINK-BELT ENGINEERING COMPANY, NICETOWN, PHILADELPHIA..... 24

Buildings, Offices and Shops—Photograph and Blue-Print Department — Employees — Workmen's Forms—Stores—Stores Receiving and Disbursement—Color Scheme of Component Tags—Department Operations—Installation of the Link-Belt Cost System and Its Development—Time Cards and Piece-Rate Cards.

CHAPTER IV.

THE FORMS OF THE LINK-BELT ENGINEERING COMPANY.. 42

Pattern Order—Time Cards—Colored Tags—Requisition on Foundry—Damage Report—Production Order—Tool-Room Report—Watchman's Report—Tracing—Piece-Rate Contract with Workmen—Bill of Material—Purchase Order—Shipping Ticket—Accident Report—Photograph Department Requisition—Daily Wages Cost Sheet—Pay Roll—Employees' Records.

CHAPTER V.

COST-FINDING SYSTEM OF THE BIGELOW COMPANY, OF NEW HAVEN, CONNECTICUT..... 101

Organization — Production Order — Tool-Room Charge Sheet—Time Sheets and Cards—Outside Work—Unproductive Labor—Shipment—Delivery Sheet—Day Books.

CHAPTER VI.

THE C. B. COTTRELL & SONS COMPANY, WESTERLY, RHODE ISLAND 113

Plan of Works—Factory Offices—Chart of Authority—Location of Officials—Mechanical Aids—Shops, Workmen and Labor Conditions—Component Tracing
 • —Glossary of Terms—Visibility in the Factory—Production Orders—Placing the Principal Order in Work—Drawings and Blue Prints—Purchasing Routine—Machine-Shop Production Routine—The Production-Order Clerk—"Red Line" Stockroom Components—Sub-Production Orders—The Transfer Clerk—The Tracing Scheme—Actual Component Transfer—The Forge-and-Foundry Clerk—Repairs and Minor Productions—Time Cards—Correspondence—Outside Work—Plant Betterment—Employees' Records—Pay Rolls—The Foundry—Accounting Forms—Traveling Salesman's Reports—Piece-Rate Cards—Work-in-Progress.

CHAPTER VII.

THE POTTER & JOHNSTON MACHINE COMPANY, PAWTUCKET, RHODE ISLAND	234
---	-----

The Potter & Johnston Product—Factory—Officials
—The Machine Shop—Bound Books—List and Trac-
ing Sheet—Workmen and Pay Roll—Day Work and
Piece Work—Purchase Routine—Repairs and Minor
Productions—Foremen's Punches—The Tool Room—
Cutting Tools—Tools and Fixtures.

CHAPTER VIII.

THE WELLS BROTHERS COMPANY, GREENFIELD, MASSACHU- SETTS	274
--	-----

Regular and Special Productions—Officials and
Organization—Factory Authority—Production Routine
—Regular Production Orders—Special Production
Routine—Sales Orders and Shipments—Sales Room—
Workmen—Machine-Tool Inventory—Tabulation Desk
Tops—The Production-Order Clerk—Stores Routine
—The Rough-Stores Room—Marking Tool Steel—
Master Ticket—Shop Order—Production-Order Rou-
tine—The Shop-Order Case—Pattern Records—Special
Production Order.

CHAPTER IX.

THE C. W. HUNT COMPANY, WEST NEW BRIGHTON, NEW YORK	317
--	-----

Business Organization—Distinctive Features—
System Charts—Rope Keeper—Travelers, Callers and
Correspondence—Drawing Room—Factory Production
—"Position" Ledger Cards—Box Office—Sales Forms
—Warehouseman—Storekeeper—Publication Depart-
ment—Outside Work—Time and Job Cards—Factory
Accountant—The Order Superintendent, the Order
Clerk and the Purchase Agent—Hunt Copying Pad.



THE FACTORY MANAGER AND ACCOUNTANT.

CHAPTER I.

FACTORY ROUTINE, ORGANIZATION AND COST-FINDING

FACTORY ROUTINE.

After a broadly inclusive study of all philosophies and religions and theories of the best life, Taine, the profound French thinker, writes, "Calm is the mental health of man," and explains his meaning of "calm" by saying, "Calm is the supreme good, for it is action, regulated and made easy."

This leads directly to the perfectly organized factory in which every act of every worker is ordered and regulated by the system, and enforced by the routine which is the product and outcome of the system.

Where the system is exactly suited to the special requirements of the individual factory, the resulting routine of regulated action is of necessity observed and followed by all operatives, because in each detail it guides and directs the worker over the very shortest and most easily followed path to the object of his desire, which is in all cases the creditable performance of his own duties with the least expenditure of his own labor and vital force.

Where the perfectly devised system results in the perfectly working routine, absolute calm prevails, and every function of the factory begins, proceeds and is completed in strict accordance with the routine, all days alike, with no waste of effort or en-

ergy, so that all the work done inside the factory walls makes towards the output of salable product.

Thus Taine's recognition of the superlative value of calm, leads directly to the highly organized factory, and to the industrial application of the same exalted respect for that tranquillity of action which is the first and most important of all conditions leading to that highest possible labor-hour production which is the highest possible human good.

The effort of the labor hour must be both wisely and strictly regulated by fixed rules before it can be brought to its highest productive effect, and the factory routine is the only enforcing agent by which such necessary rules can be made effective. The routine is the product of the system of organization, and the routine must direct and guide the worker not only to the desired results, but to the obtaining of these best results with the least possible exertion. When the best way is also the easiest way it is sure to be followed, and thus the perfected organization creates the effective routine, invariably observed and pursued by the workers because it is easiest, and so Taine's desired condition of calm is secured, and this happy tranquillity gives the opportunity of the highest possible labor-hour production, which is not only the highest possible human good, but is also the crowning triumph of the factory manager's battle with the industrial elements.

FACTORY ORGANIZATION.

Let us go a little further into the reasons for factory organization.

Take the common case of a successful factory producing a commodity in good demand, making some money, and growing steadily. There are thousands of such factories in America to-day, many of them managed by the second or third generation of the same family, thoroughly established, each well known in its line of manufacture. Such a factory has an internal economy evolved from very small beginnings, quite probably a thing of shreds and patches, and likely to be more thoroughly efficient in some details than in others, and very commonly not exactly defining the functions of its officials, and so not working at all

times with perfect smoothness, but yet fairly satisfactory in results if carefully followed and watched.

Why change the routine of such a successful factory? The owners are working in harmony, all of the conditions are salutary, and the future outlook is assuring. Why not let well enough alone?

Close acquaintance with such a factory and careful scrutiny and analysis of its workings always reveals one leading manager, who may or may not rank as such, who exercises a general supervision over the conduct of affairs, and virtually carries the works on his own shoulders, and is overtaxed by responsibilities voluntarily assumed when clearly seen.

Certain things must be done. The factory product, whatever it may be, must be kept up to the times, constantly improved and made more desirable, as well as cheapened by added value or cost reduction, one or both. Whatever pauses, falls behind. The factory which is to live must advance, and this leading mind of the not perfectly organized factory has, first of all, the advancement of product in view. Next to this imperative demand for product betterment, comes the improvement of production elements which shall increase the factory's labor-hour efficiency. This is also an unavoidable necessity, and must be satisfied. The third division of the general manager's labors is the hateful drudgery of adjusting the faulty mechanism of the factory routine so that this small delay, or that evidence of hurtful friction, or these little clashes between minor officials may be alleviated, smoothed over and adjusted so that the factory product may continue to reach its buyers.

While the business is comparatively small the manager depends very largely on finding exactly suitable men to fill the places; he carefully selects his subordinates, each of whom must perform more than one function, and must have some latitude of discretion, and is expected to, and does judge for himself what shall be done and when he will do it. As the volume of business increases more of these specially-fit minor officials are wanted, and better ones, and these are hard to find.

Here the manager is driven to the wall. His higher labors in the direction of product betterment and plant betterment cannot be put aside and cannot be transferred. Those things he must

himself improve, and this work, which no one can do for him, he feels to be all that he can well perform, and he finally resolves to free himself from the pin-pricks and gnat-stings of petty factory happenings, due to want of intelligence or want of application to duty on the part of his subordinates. The manager has been careful in selecting these minor assistants, yet they do not meet his necessities. If forceful, they invade the domains of others, if willing, but unenergetic they fail to do their own work. The manager finds that each subordinate should have duties within the scope of moderate powers, and that these duties should be clearly and rigidly defined for the performance of each one. Finally, the manager realizes that each act of every subordinate must be recorded with the time of performance, because nothing short of this time record vouching the doing of all the things ordered to be done, will keep his subordinates up to the mark of efficiency.

When the virtual dictator of the unorganized factory reaches this correct perception of the necessity for defining the duties of all subordinates and recording all of their performances, he at once becomes aware that the same reasoning applies to things as well as to men in the factory, and to his nominal equals in rank as well as to subordinates, and this perception leads immediately to factory organization, in which duties and functions are clearly and rigidly defined, performance records are regularly made, and things of the factory are located when at rest, and traced when moved.

As the able manager looks over his own particular industrial kingdom, small or large, in the new light of defining and recording inevitabilities, and considers the means by which he shall place and direct his assistants and record their acts, and shall also place and record the movements of every piece and thing inside the factory walls, he is appalled by the endless series of record-forms needed, and the endless labor of writing the records not only of the worker, but of the record-maker as well; he sees printed sheets without end, scribes in myriads, clerical-labor costs beyond reason, red-tape fettering every function of the factory, and often pauses long before he inaugurates the change. But he can see no other relief from the intolerable annoyances of his own position. If the small things are not made

right, the manager cannot give his mind fully and freely to his own task of making the great things right, and decay and ruin confront him.

At any cost, then, the whole factory, men, deeds and materials alike, must be placed, and must be recorded. There is no other way. The form-blanks must be printed, the card-index trays and cabinets must be installed, records must be made, duties must be defined, and, in short, the whole factory must become a machine in which every part and component is constrained, guided and impelled to the certain performance of its intended function. When this is done, and not until then, the directing mind of the factory can be free to exercise its powers in the lines of mechanical and commercial advancement, instead of wasting its efforts in correcting the irregular workings of the factory itself.

When every man's duties are rigidly defined, and accurately kept records show that those duties are performed, and every piece and thing which enters the factory or leaves it, or is moved or worked within the factory walls, has its full story written down in comparable records, then the factory is organized, and its highest usefulness may begin, and the manager may then carry on and advance his establishment so far as the best use of his own powers will suffice.

The existence of every factory begins with the thoughts and efforts of some one man specially fitted by his natural bent of mind for the task he was born to undertake, and which he carries to success by force of his native fitness. He does his own work easily, his whole energies are devoted to a single object, and in most cases, the results of his own labors are satisfactory from the first. Of course, first products are always vastly improved in the course of time, often to such an extent as to be hardly recognizable as the outcome of the original creation, but the original ranked well up among its rivals of its age, and subsequent improvements have kept it well to the front, without intolerable exertion on the part of the originator. But from the very first it has been difficult to obtain wholly satisfactory production agents and selling agents, and as the business grows the factory plant becomes more and more specialized and efficient, and the selling value of the labor-hour product steadily increases. With the growth and betterment of the factory and the factory product

comes a constant demand for better subordinate officials. There is never any great difficulty in finding hour-wage workmen who can do what is expected of them, because their duties are simple, and are always clearly defined, and in most cases the workman is paced by the machine which he uses, and his rate of efficiency advances with plant betterment. But plant betterment does not much influence the efficiency of subordinate officials, who must have some degree of initiative, and must have some latitude of discretionary effort, and at the same time must be docile and tractable and contented with routine exercise of their powers. Those who cannot assume a thoroughly subordinate mental attitude are not useful to the factory manager; they may be abundantly capable, but as between the subordinate of too-much ability and energy, who must be constantly held in check, and his fellow, who has perhaps equal mental perceptions but not quite so much combativeness, and so requires at times a little pushing, the manager's choice falls on the docile one. The energetic subordinate is the more valuable in emergencies, but emergencies are evidences of imperfections somewhere, and may be avoided very largely by the teachings of foresight-giving experience.

By assigning clearly defined and distinctly bounded duties to minor officials, the manager can use a wider range of energy in his subordinates, and so obtain men he can use more readily, as he has a wider field of selection. The strict system holds the too active man back, and urges forward those who are somewhat wanting in push. Routine duties are easily and willingly performed, exactly in proportion as they are minutely defined and timed. The minor official who has precisely similar duties appointed him for each hour of each working day, and has to keep step in the procession with the man behind him and the man in front of him, has his work cut out for him in the best possible manner, and so is most likely to be satisfactory in the performance of duties expected.

Thorough factory organization places the minor officials in this desirable environment of certainty and continuity, and thus converts them into reliable links of the steadily moving chain of factory production events, and it is this happy influence on the condition and performance of the minor official which forces the very highest form of organization on the factory of to-day.

"I do not know," said the principal director of one of the most completely organized of American factories, "how many separate form-blanks we are using. We are using a great many, and we shall use more. I do not think we shall ever use fewer. But," said he, turning to his general manager, "I do know that if any one had shown us, even five years ago, the form-blanks we are using to-day, we should have said that such detail was not only absurdly unnecessary, but that it could never be carried out. We should have thought it an impossibility."

"That is true," replied the general manager.

"Yet we are using it," continued the principal director, "and it saves money, and avoids annoyance and confusion to such an extent, that we would not think for a moment of going back to our old simpler methods of operating the factory. It is just the other way, we shall still further increase our subdivision of records. The effect of our change towards complete organization is to put me, myself, outside of the factory doors, where I belong. There are things we do not do yet, and which are unthought of inside the factory; I know something of them, the drawing room knows something of them, but it will be months before the factory knows anything at all about them. I did not know I could get out of the factory; I thought I must stay inside of it, because, as it was formerly operated, I had to be in it to keep things moving. Now I find the organization does all that I did, and does it far better than I did it, and that I am left free to meet demands for betterment of our product which I know will be called for, and which will be supplied by some one else if we are not ready when called upon. The factory organization puts me outside of the factory doors, and for that alone it must be continued. But the organization, the reducing of everything to system and the establishment of routine factory practice, is of benefit in every way. It makes cheaper work, and it makes better work. It seems an impossible thing because of its complexity, yet it simplifies the work of every man in the place, my own work, and that of everybody else. The system of complete organization is right, and all factories are forced to begin organizing, and when the beginning is made and some of its advantages are seen, then it is certain to be followed up, and carried to the limit. What and where that limit is, I do not know. I do know we have not

yet reached it, and I do know that we have gone far beyond what we once thought possible, and that we have been great gainers so far, and have not got through yet. I don't know how many form-blanks we have in use, but we shall use more."

COST-FINDING.

Granting the truth of what goes before, and it is so obviously true that the mere reading of the plain story carries conviction with it, it is pertinent to consider factory organization as related to factory production costs and cost-finding.

First as to the true and vital objective of cost-finding: The cost-finding organs and functions together comprise certain things manipulated in certain ways, by which a more or less close approximation to the total cash-outlay cost of a factory product may be obtained. But this finding the costs of things which have been made is not at all the true object of cost forms and procedures. What has been, has been, and belongs to the dead past, which no man can change. The factory accountant does not watch the expenditure of the individual minutes of the factory labor-hour as a cat watches a mouse, merely to find out what has been done.

Still, like the vigilant cat, his real designs reach into the future; the cat hopes to make a meal of the mouse, and the cost-keeper hopes by ascertaining the cost of past production to be able to accurately predict the cost of future similar productions, and thus, still like the foresighted cat, provide for his own certain maintenance in time to come.

In a word, the cost-keeper has no desire to record the factory past, save as a guide to the best management of the factory in the future. There is but one sure guide for the footsteps of man, and that is the lamp of experience. We can assume with perfect safety, when considering large fields, that what has been, will be. Thus, to particularize, we know that factory production costs of any specified article, considered at large, will always fall under continued intelligent effort. The selling price of every labor-made value, even that of gold itself, is constantly being reduced.

But this is the large view, and, as it happens, the individual factory manager does not care at all for the large view, because

no one factory manager can ever hope to control so large a proportion of the total of any manufacture as to make deductions from the wide view a certain guide for his own future performance, more than to know perfectly well that he must advance or fall back, one or the other, and that he cannot remain stationary, but must exert all his powers to retain any success that may once be his own. But within his own more or less limited sphere every factory manager may, and indeed, must be guided by the large view that all labor-made costs must continually be decreased.

Outside of this one broad truth, the factory manager's view must be strictly bounded by his own factory walls, and the view which interests him is not the broadly inclusive survey which includes the continental or even world-wide balancing of probabilities, but the probabilities of the future performance of his own comparatively microscopic holding in the vast industrial domain.

The factory manager's real objective in cost-finding is thus clearly seen to be the accurate prediction of future production costs, barring accident, in his own factory. The cost sheets say the last production cost was thus and so. Can the manager assume that the next production costs of the same article will be surely not more, and probably something less?

In the endeavor to obtain a certainly correct reply to this vital question, which must be answered "Yea," if cost-finding is to be held worth the price of the paper on which its form blanks are printed, consider for a moment, an ideal but not impossible factory, using wholly automatic plant, no workmen beside independent tool-makers, equipment less than one year installed, stock delivered at the factory door at yearly contract rates having yet six months to run, electric driving power under the same time contract, strikes and accidents barred. These conditions involve fewer chances of miscarriage, perhaps, than obtain in any actual factory. Will the next production cost as little or less than the last production? As surely as any human certainty can be sure, the next production will not cost more than the last production, and there is a largely preponderating expectation that the next production will cost a little less than the last previous production. The manager is wise and vigilant; the tool-makers are skilful and ingenious; they have the light of experience, and they will probably be able to do a little

better next time than they did last time. Or the fortunate thing may occur. One of the tool-makers may have placed a real improvement just in time to influence the cost of the next production, and in this case the next cost is sure to be the smaller.

How does this ideal supposition differ from the actual everyday factory? The ideal factory gives the original question the affirmative reply needful to support cost-finding as an industrial economy. If the actual factory does not differ essentially from this ideal factory, then cost-finding seems to be correct practice. How do the two factories differ? Simply in organization. The ideal factory is as perfectly organized as any enterprise directed by human intelligence can be. Its motive power and rough-stores costs are fixed. Its labor costs are made to the most able and willing artisans known. The management is wise and keenly observant.

It is very clear that no actual factory can ever reach the superlative conditions of the ideal factory here considered. But the higher the organization of the factory, the more nearly the factory approaches the condition of automatic plant equipment; men are not machines, but by the use of methods and means well known to-day in factory practice, men may be brought to clock-like regularity of action during their hours of factory service, and may gladly and happily meet every factory labor requirement, without the slightest loss of self-respect, or the slightest consciousness of surrender of independent volition.

When the non-automatic factory plant can be handled by automatic labor, then the whole factory becomes an industrial automaton, and its chances of making its next costs less than its last costs may be safely calculated from mortality tables, because the factory-routine environment of its labor becomes so forcefully potent that the expected change in laboring individualities will make no noticeable production cost differences.

If these assertions as to the effect of high organization on the factory labor-hour product are true, then a conditional answer may be given to the original question as to the safety of basing future production estimates on past production costs.

If the factory is highly organized, then past performance is a safe basis for future expectation; it is certain that the factory machines will do a little better in the future than in the past, and

it is also certain that with the best factory organization now known, the labor-hour production of the future will be something higher than in the past, always so far as any human perceptions can foresee.

But if the factory is not at least fairly well organized, then past performance is not a safe basis for future expectation. The machines are not sure to equal past production effects, because the machine output is so largely dependent on the labor effort, and the want of factory organization makes the labor effort an uncertain factor in the result.

The circle has no end, and all problems of factory management are circles, and the present cycle of cost-finding permutations now returns to factory organization, where cost-finding begins. Factory organization enables the costs of past productions to be ascertained, and factory organization makes it safe for the manager to base his estimates for future production on his past costs, and, again the circle, precise cost-finding enables the manager to strengthen and perfect his factory organization by pointing out the precise location of factory ailments and disorders.

So factory organization and factory cost-finding must unite to constitute the steadily revolving wheel of factory production of commercial value. As this modern embodiment of fortune's wheel revolves, sometimes cost-finding will be most in view, and sometimes factory organization will hold the more prominent position, but in truth the two are one and inseparable, and must thrive or decline together, and the greatest good of the greatest nation of the earth must come from the highest possible development of factory organization and factory cost-finding.

CHAPTER II.

ADVANCES IN FACTORY ACCOUNTING.

When the gathering of material for "The Complete Cost-Keeper" began in 1898, very few factory managers of the large number approached showed any willingness to place their cost-finding methods and practice before the public. Some objected to giving competitors the results of their own hard and costly labors in the form of fully worked-out systems which rendered satisfactory returns, while others, having perhaps the higher conception of what ideally perfect cost-finding should be, were not at all contented with their own procedure, and frankly gave the imperfections of their practice as a good and sufficient cause for refusing publication. Another class of managers resented requests for cost-finding information as wholly unwarranted intrusions on the privacy of their business economy, and were curtly and emphatically explicit in both matter and form of their indignant refusals to show their methods, even under seal of secrecy. Yet another view of the matter of publishing actual cost-finding methods was exhibited by quite a large class of managers, who were very willing to fully disclose their practice to others in the same line of work, where it would seem at first sight most unlikely to be given, but who absolutely refused publication, alleging that the public at large was not interested in such things, or, if interested, had no color of right whatever to the information. This curiously contradictory mental condition which could lead a manager to give other workers in his own line full information, while refusing it to strangers and outsiders, seemed to spring from a conviction that the methods in question were quite surprisingly perfect, and hence gifts of great value if given at all, and so to be bestowed on dear friends alone, and on them only as an act of gracious condescension. In one instance of this kind, where refusal of examination and publication was

prompt and acrimonious, the manager went to the trouble of having the whole of his voluminous and complicated practice type-written and presented to a larger concern than his own, which had asked for assistance in this line, but which, after all, as may be profitably here noted, did not make any use of the mass of cumbersome forms thus obtained.

There was, however, in 1898, a very great manifestation of American interest in factory betterments of all descriptions. We had at that time, without being fully aware of the fact, placed ourselves in a position where the markets of the world were opening to our products, although Europe yet regarded us as a nation made up of plodding farmers and wild enthusiasts, incapable of large effects demanding broad prevision and determined cohering effort for success; and while admitting American possibilities in food production Europe yet denied us consideration as fighters and manufacturers, the theory being that we were a nation of rather active individual workers, but incapable of united effort. Then came the wholly unexpected revelation of our military strength, and the exhibition of our fuel and steel resources, and with the suddenness of the flowering of the century plant, the American industrial aloe burst into blossom, and as in a single night, we took the place among the ruling and producing nations of the earth which we must inevitably hold through the twentieth century.

It is not too much to say that this end-of-the-century recognition of comparative national values was as great a revelation to the Americans as to Europeans. We were aware in a general and superficially-considered way, that we were good workers, and that we had large natural resources to draw upon, beside our vast area of productive soil, but we had no realizing sense of what our money and coal and iron and copper and zinc and abundant food, taken together and used boldly, could do for us.

IMPORTANCE OF COST-FINDING.

The last five years have vastly enlightened us as to comparative national industrial possibilities, and the American factory manager has taken on a new importance, born of fitness and opportunity, and at this moment factory betterment, as a requisite

of our American position in the van of the world's producers, is the supremely interesting problem of the Western Hemisphere.

Accurate cost-sheets, mere prosaic, wholly uninspiring records of the production prices of the commercial values created by the miner's pick, the smith's hammer and the weaver's shuttle, are fully recognized as the only foundation which can give permanent stability to the towering structure of our industrial organization. We must know what our wares cost in gross before we can fix our selling prices, and we must know these costs in detail so that we can make the production costs smaller than other nations find possible.

We are now fully aware that to make large sales we must offer desirable commodities at low prices, and we fully realize the fact that production costs can be reduced only by unceasing vigilance in scrutinizing the minutely-divided items of production cost. It is of no avail to know merely that an article costs more than need be; before the cost can be reduced, the precise production detail which can be diminished in cost must be known, so that appropriate remedies can be intelligently applied where they are needed and will be beneficial.

In this view, accurate cost-finding becomes of the highest importance to the factory and the factory manager. Commercial values are wholly labor results, no more, no less. Where nature has done most, man can do most. We have a fertile soil, rich mines, a healthful climate, abundant sunlight and willing workers, all in excess of the older nations of the world, and we now see that if we can but wisely direct our labor we may manufacture products of all kinds and varieties at less cost than the older countries.

THE INTERDEPENDENCE OF MANUFACTURERS.

We are also beginning to see that success and wealth cannot be rarely-occurring individual matters. The manufacturer must have customers. The maker must have the buyer. Factory practice begins with the creation of the production order, and the production order must come from some one who has money to pay for the completed product.

Hence the benefit of one is for the welfare of all. He who makes good use of his production possibilities must always be

a better customer and a more abundant and promptly-paying purchaser than the less thrifty one who fails in economy.

This view, which is certainly correct, links the whole of the factories and factory managers together closely, and makes the continuing prosperity of the individual absolutely dependent on the prosperity of the community at large. What helps all, helps each. What hinders one, hurts all. Neither gains nor losses are solely individual affairs, and all of these obvious truths are now recognized by advanced American factory managers, so that those who are most fully aware of the value of intelligent factory organization are most ready to tell all they know, and to help others along the road to prosperity, fully realizing that there must be a market for product if the factory is going to make money.

Because of all this, because of the Spanish war, and because of our great advance towards opening the world's markets to all our products of both farm and factory, it is far easier to obtain access to good factory accounting systems now, than it was four or five years ago, when "The Complete Cost-Keeper" was put together, and some of the largest and most successful American factories have willingly afforded the fullest opportunities for examination and publication of the productive methods which appear in this volume.

MANUFACTURERS SHOULD EXHIBIT THEIR PRACTICE.

In the broad view of the situation, the wide-open and fully-revealed factory is not only not surprising, but is the only rational determination of the matter. The successful factory manager is fully aware that he has reached a commercial certainty for his own future, and so become a sure and promptly-paying consumer of the products of other factories, only through a long succession of partial failures, which, while leading by slow and painful steps to final triumph, often hindered his own past purchases, and the successful manager well knows that his factory organization is the basis on which his own desirability as a purchaser is supported. The able factory manager also knows well the value of that indirect patronage which goes to make up the mighty current of the ever-flowing river of commerce at large, and en-

ables his direct customers to buy more largely of him and pay him more promptly because they are themselves better producers and command wider markets and quicker returns than if they were less well equipped than he himself with all the modern improvements which make for factory economy, advancement and prosperity.

THE FACTORY MANAGER'S BEST INFORMANT.

As to the form in which factory cost-finding theory can be best studied, it seems that actual applications of this theory, proved by practice to give profitable results, must be far more valuable than the mere general views and opinions of any single factory accountant, no matter how able and expert he may be. The study of the applied and concrete thing is much easier than the application of unembodied possibilities, however correct may be the theories on which they are founded.

In this view the actual forms used in cost gathering by a successful factory, become industrial exhibits of the highest value and the deepest interest. However much the cost-finding forms and methods of two dividend-paying factories may vary, the certainty that both are used with success shows that they both deserve careful consideration.

Moreover, a comparison of two different methods for obtaining the same desired result, invariably leads to succeeding improvements.

"The Complete Cost-Keeper" was the first book to attempt the solution of factory-accounting problems by showing, in full detail, exactly how these various problems had been met by the original work of those pioneers who laboriously made a path through the unknown and untrodden fields of factory economics.

The highly gratifying favor, exceeding all expectations, with which "The Complete Cost-Keeper" was received, was undoubtedly due to the fact that it was a compilation of actually employed forms, and this success leads to the expectation that the additional cost systems given in the present volume will add vastly to the real value of the work, because these later systems of cost-finding cannot fail to represent in some degree at least, the advancements and betterments inseparable from four or five years of the greatest and best industrial advance the world has ever seen.

IMPROVED FACTORY MANAGEMENT.

The vast increase in total value of American factory output in the last five years has been more than met by increase in general knowledge of the essentials of factory accounting; there is in no case any disposition shown to return to lump sums and aggregations of prime costs differing but slightly in origin. On the contrary, the plainly-manifested tendency is toward that entire separation and resolution of costs into final distinct elements, which alone can give the works manager a commanding grasp of his entire labor costs. Some old concerns, enabled to survive by virtue of location and environment, and by natural foresight which gave successful general plans of procedure, have more than held their own, without greatly elaborating their early methods of accounting. In most cases, however, these users of systems embodying few forms and so giving less detail of information, have comparatively simple lines of manufacture, mainly repetitions of well-known and long-accepted commercial forms.

In the case of comparatively new lines of manufacture, very elaborate cost systems, using large numbers of different printed forms are the rule. Efforts to reduce the number of forms by making ingenious combinations by use of which several distinct cost details, allied in origin but demanding separation, may be recorded on the same simple form, are naturally the first resort of the experimenting cost-keeper. The system should be as flexible as possible, as simple as may be, and should be wholly inclusive, and yet the number of separate forms should be the fewest that will give record space for the really indispensable cost of details. When a cost-keeper begins to see clearly that he cannot reduce cost without detailed information, he is dismayed by the multitude of form spaces demanded for the separate item records which he sees he is forced to make, and appalled by the vision of an interminable succession of cost forms, and so seeks to make combination cards which will reduce the number of his form blanks, and the combination forms thus evolved often show great ingenuity, and appear at first sight to be very valuable aids.

MANY SIMPLE AIDS PREFERRED TO FEWER COMPLEX FORMS.

But one machine is like another machine, and cost-finding machinery invariably goes through precisely the same simplify-

ing processes that are applied to special tools for metal working. Highly ingenious combinations, difficult of production, delicate, and liable to vagaries of action, are replaced by devices of robust simplicity, easily understood, and certain to do the thing wanted done. In one stage of machine-tool development, carefully-devised combined tools were in favor, and lathes and milling machines were made in one, as were slatters and drillers. These combinations had really good points, but they have wholly disappeared. This is the rule with all machines and industrial appliances. Ingenious combinations at first, simplicity of elements, separation of processes, and multiplication of production steps at last. It is better to use many sure, simple aids than to use fewer complicated devices. Following this general law, the experienced cost-keeper uses a large number of simple forms, avoids combinations, and adopts a final policy of separate forms for separate items, because he finds, often by unhappy experience, that it costs less money in the long run to employ many simple tools, than to make the changes and selections demanded by fewer but more complicated forms.

ECONOMIC FUNCTIONS OF COST-FINDING.

In no case does any modern concern show a willingness to accept costs not minutely detailed. The object of all cost-keeping is to reduce production cost, and this can be done only by reducing the labor-hours item of the costs which fix the selling price.

It is not unusual to hear the assertion that since labor is only 10 or 15 per cent. of the selling cost of a certain manufacturer's product, it cannot be of great importance to reduce the labor total, because it would not greatly cheapen the product if the entire labor cost was eliminated. This view is wholly erroneous. All costs, of all manufactures, are, without exception, labor cost. Natural values of minerals in the mine, timber in its native forest, sunlight, air, rainfall, a fertile soil, and falling streams to furnish water power, are simply territorial gifts, as largely bestowed by nature to the interior wilds of Africa, where they now produce no part of the world's commercial value, as they are to the most thickly populated parts of the civilized world,

where every natural utility is made a source of gain through applied labor.

STATES AND NATIONS ARE LABOR PRODUCTS.

Before natural values can become commercial values, they must be discovered, the territory which contains them must be acquired and held, lines of transportation must be opened, and peaceable and salutary living conditions must be established; all of this must be done before dominant industrial effects can be produced.

Thus the labor of the explorer, the pioneer, the soldier and the statesman must precede the establishment of territorial values at large so that the solitary wilderness may become the populous state, always representing a vast investment of labor which has been performed under unfavorable conditions, and is, up to the time when the new nation begins to be more than self-supporting, non-productive of commercial values, which are always surplus products, excesses above the cost of labor sustenance and management.

When a community or a nation begins to realize a profit on all this enormous investment of unproductive labor which has given the possibility of converting the potential values of savagery into the commercial values of civilization, then comes another vast expenditure in road making and shipbuilding. Since all commercial values are surplus products they must be carried away from the place of making to the place of selling, and when lines of transportation, quick, sure and cheap, reaching from all producers to all purchasers are furnished in ample capacity, then the industrial chain is completed, and the day of the manufacturer begins.

ENTIRE AND PARTIAL MANUFACTURE.

No one maker of things to sell can ever be the direct employer of all the labor represented in the value of this product. Every American manufacturer of to-day is a user of the Spanish labor which equipped Columbus for his voyage of American discovery, of the labor of Watt in perfecting the steam engine, and of the labor of Washington's Army of the Revolution in securing to the United States the peaceable use and employment of the vast territorial resources of our continent.

A factory may work from the mine to the finished commercial product in its most elaborate form, or the mine may end with ore at its mouth, the smelter may take the ore and turn out the contained metal in rough ingots, the forge and rolling mill may convert the ingots into sheets and bars, and the factory completing the commercial product, ready for sale, may work the sheets or bars into one or more of the myriad forms in which metals now go to the final users, but in any and every instance it is labor, and labor alone, which appears at last as the total production cost of the completed article.

Labor costs are the only costs that can possibly be made, and labor is the sole creator of values. Capital is but accumulated labor, and has all of labor's earning and value-creating powers. Hence labor-cost reductions are the only reductions possible in the cost of manufactures.

THE SPECIALIZED FACTOR.

This broad assertion that labor costs are the only costs of commerce and manufactures at large, must not be understood as saying that labor costs are the only costs known to individual factory operators. On the contrary, where the modern scheme of specializing factory product is carried out, the rough stores of such factory are always the finished product of one or many previous producers, whose labor costs of operation and profits are included with their preceding stores cost, in the price which this final factory manager must pay for *his* raw material. Factory managers who add but a small increment of labor to a product already heavily indebted to previous handlers often lose sight of the labor costs included in their rough-stores purchases, but very brief consideration of this case shows that labor cost alone fixes the selling prices of this final manufacturer, the same as it fixed the selling prices of those before him. The final manufacturer simply buys labor with the profits of a previous manufacturer added, and if he has a costly plant to maintain, as is often the case, his fixed charges and rough-stores cost may easily make up nine-tenths of his selling prices, but none the less the whole cost of his product is found to be labor cost, when resolved into its ultimate elements, and, such being the case, the reduction in his prime costs must come from lessening the costs made before he

began his work. These costs were made by other makers than himself, and can only be reduced by improved factory practice of his predecessors, thus making the special manufacturer the more dependent on the economic procedures of the producers of his raw material for his possible cost reductions, than on his own reductions of labor cost in his own factory.

Thus, in the case of the special maker, whose operations are limited in scope, it is clearly to his great advantage that the suppliers of his raw material should be efficient cost-keepers, and thus be able to lower the cost of their product to him while at the same time increasing their own profits by his increased purchases and the combined increased yearly turn-over, due to increased buying of the combined product by users at large, who invariably increase the volume of their purchases as prices decline.

THE NECESSITY FOR COST REDUCTION.

Why seek to reduce the cost of an established manufacture, in good demand, giving universal satisfaction, and paying every handler and user good returns?

So far as the manufacturer is concerned, if by patent or by location or ownership of natural products that manufacturer is a monopolist, and has his own field certainly all to himself, he gains nothing directly by lowering his own factory labor costs. But if the manufacturer has one single rival, then the battle is on, and must be fought for every inch of selling territory and for every customer, no matter how small his purchases, and the manufacturer whose armor and arms are the less effective must fall back in the conflict and fail finally. Even granting monopoly, the manufacturer must reduce his costs to the lowest possible point because his constant large gains must find employment, and hence the manufacturer demands a market of constantly increasing area containing more individual purchasers, and so must manufacture for less cost in order to meet added transportation charges, and to retain his users by giving them his product for less than the cost of some possible substitute therefor. Hence the monopolist manufacturer must work toward labor-cost reduction, precisely the same as if he were in competition with similar rivals, because of transportation necessities and substitution possibilities. Again, the monopolist manufacturer, if such exist, is a buyer

as well as a seller, and so profits by low labor costs of others, and the cheaper he can sell his own product, the cheaper others can sell their productions to him, and the more gains accrue to all concerned.

LABOR COSTS THE PRINCIPAL FACTOR OF ADVANCEMENT.

So labor costs underlie every scheme of human ambition. "The less the labor costs of any operation the greater its probability of success, and the greater the gains to the human race at large from its practice, because increased commercial value of the labor-hour is the only agent which can possibly advance the welfare of the human race at large."

This is not a mere fanciful theory. Imagine human existence in cold or desert places, where the whole energy and ability of the individual barely suffices for maintenance and reproduction purposes; here all advance becomes impossible. There no gain and no storing away of labor accumulation is possible, because all labor products are barely enough for present consumption. But where the gain can be sure, though it be but small, there advancement begins, and once begun, continues and increases, because labor is aided by foregoing labor accumulated as capital, vital and wage-earning if wisely handled, the same as that of the living toiler who works with his hands.

Hence this is the one problem of the world's advance, to make the labor-hour produce its highest possible returns of commercial values, so that the fewest labor hours may make the wealthiest nation, which will forever be the wisest, the freest, the most benevolent and the foremost nation of the world.

Now, in order that the labor hour may be made most efficient, it is necessary that the cost of labor be known, so that possible defects in operations may be recognized and proper remedies applied. It follows, therefore, that factory cost-finding is the principal agent in human advance towards the final best for all mankind. This conclusion is not a fall from the cloudland dream of human betterment to the sordid level of the factory worker's time-card and dinner pail and hard-won wage; it is the absolute truth, and accurate factory costs are the sole uplifting agent of the factory and the factory's workers.

The factory manager at large is not a pirate or a slave driver

in his heart. He must be intelligent, and he knows, if he is intelligent, that the best-fed and happiest factory worker is his most profitable wage earner. "A vast and constantly increasing portion of the human race must be hour-rate wage earners, and whatever helps to make the labor hour earn more money helps the whole world on its way to the Final Best."

"If this view is correct, ~~and its correctness~~ is amply proved by all the events which have followed the wonderful advances made on the commercial value of the labor-hour product in the past century through the use of improved machines and factory methods, then the art and science of factory accounting is of the very highest importance socially and politically, ~~and~~ this book, which carefully explains and exhibits for the first time some of the best forms of factory accounting now known, marks a new step in the advancement of our race."

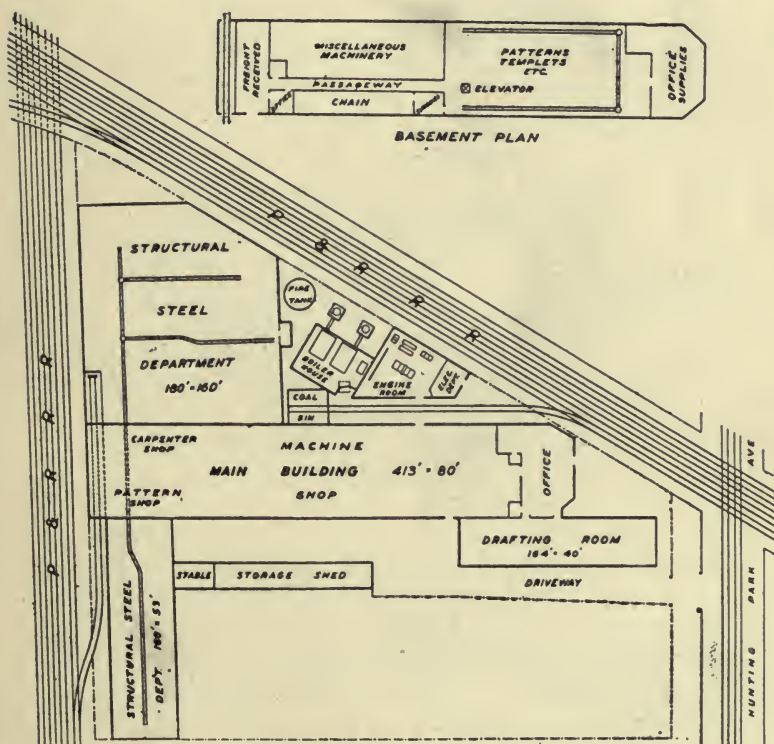
CHAPTER III.

COST-FINDING SYSTEM OF THE LINK-BELT ENGINEERING COMPANY, NICETOWN, PHILADELPHIA.

This company works about 325 men, under extremely favorable conditions as to housing, sanitation, light, air supply and drinking water. The factory fronts south, with drawing rooms to the left, level with the offices and machine-shop floor, on a plot of ground lying on the west side of the New York branch of the Reading Railway, as shown in the accompanying plan. The ground declines slightly from front to rear, so that the office entrance is on the street level, and the general factory stores entrance to the floor below the machine shop is also on the ground level, at the rear of the main factory building, which is 413 feet long by 80 feet wide. The wrought-shop storeroom, a separate shed, stands to the left at the rear, and houses plates and rails principally, while the wrought shop itself, on the same lower level, occupies a much wider extension at the rear on the right. The shipping room occupies the front part of the machine-shop floor, immediately in the rear of the offices, and is not in any way separated from the main machine-shop floor, which runs the whole length of the building. The pattern shop is at the rear end on the left-hand side, again with no partitions to separate it from the machine shop. The machine-shop tool room and the machine-shop foreman's office are about mid-way of the main machine floor, on the left-hand side. The wrought shop includes the sheet-iron workers, structural-iron workers and blacksmiths.

A driveway extends along the left side of the factory to the railway at the rear, ending at the railway, between the main building and the plate-and-rail stores shed. This shed is built close to the railway tracks on the north-west, and has plate-storing-floor doors opening to the track at car-floor level, so that

plates and rails are handled directly from the cars into storage. A narrow-gauge railway runs through the middle of the plate-and-rail shed, crosses the drive-way and extends on through the main lower floor and wrought shop, with turntables and cross-tracks in the wrought shops, thus making easy transportation from the plate-and-rail shed. The rear line of the wrought shop also opens on the railway. A siding from the railway line on the north-east runs between the power house and the main machine floor, close to both, extending back to the wrought shop.

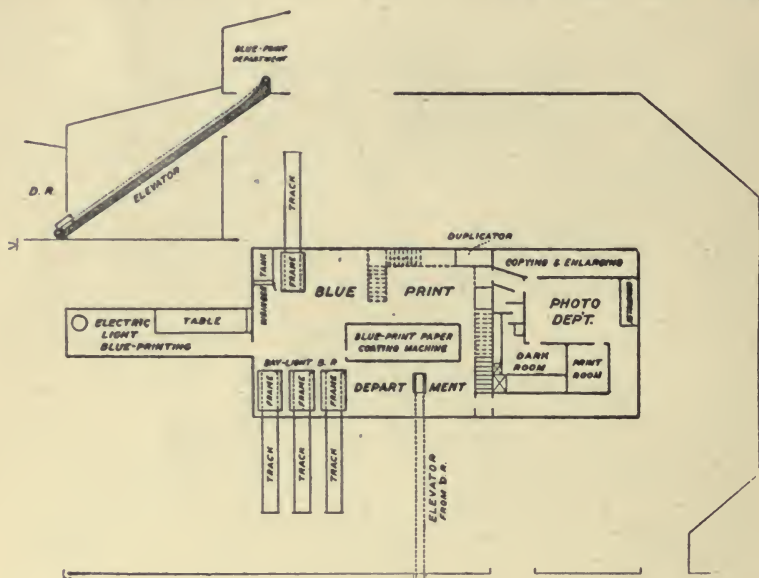


PLAN OF LINK-BELT ENGINEERING CO.'S BUILDINGS.

All this gives wagon way to the front and entire left of the factory, with railway across the rear, railway on the right, and a railway siding leading from a switch in the Reading line into the

buildings plot, which, with the electric trolley line in front, gives very ready transit for men, materials and product.

The offices are approached through a small and well-kept grass plot ornamented with foliage plant borders, and over the main door is the legend "Visitors Always Welcome." The factory is about four miles from the Market Street terminal of the Reading Railway in the business center of Philadelphia, and numerous Reading trains from the Nicetown station, just across



LINK-BELT ENGINEERING CO.'S PHOTOGRAPH AND BLUE-PRINT DEPARTMENT.

the street from the factory entrance, give a 5-cent fare into town. The Reading road now runs a fast train every hour to New York, the time being about two hours, so that transportation to both cities is constant and speedy.

The offices are in front, with photographic and blue-print laboratory above, engineering department and drawing room to the left, and motive power building to right, with boiler room to the rear and below. Most of the power used is electric, and much of the tool and machine driving is by individual electric

motors with silent chain transmission, the plant being modern in every particular.

The policy of the management has for its objective a high labor-hour output, the management believing that this can be most easily obtained by sedulously promoting the most cordial relations with its employees.

About 325 officers and operatives were employed in October, 1902, organized as follows: One chief engineer, who also acts as general superintendent, one assistant chief engineer, one chief draftsman, 30 draftsmen, 4 commercial accountants, one chief cost-keeper, acting also as paymaster, with 5 assistants in cost-keeping, 2 time clerks, 3 shipping-room clerks, with 6 shipping-room packers, 67 machinists with foreman and assistant foreman, 17 pattern makers with working foreman, 79 sheet and plate workers and blacksmiths, with foreman and assistant foreman, and a gang of 20 laborers with one foreman. There are two tool-rooms, one for the machine shop and one for the wrought shop, the latter being merely a convenience in charge of a lad, one machine-shop tool-room foreman and 12 tool-makers. The electrical department, in front of the motive power and dynamo and air-compressor room, has 4 working electricians. The power house has one engineer and two firemen, and the storeroom has one foreman in charge of 9 laborers. One night watchman and an outside force of erectors, fluctuating in number, make up the working force. The erectors work in gangs, each under charge of a superintendent engineer, who makes the time sheets for his own men.

All other workmen record their entering and leaving time by pressing their individual number plungers on a time recorder, perforating the clock-moved record sheets.

The night watchman records his station visits by use of watchman's detector sheets, and fills a diurnal report, form 42, which, together with the other Link-Belt forms, is shown and described in Chapter IV. These records are the only ones made by workmen.

WORKMEN'S FORMS.

When a workman is hired into the shop, notice of engagement is made on form 139, which, after approval by the superintendent,

goes to the paymaster, who fills form 167, a stiff, white card, with employment-entering items, and files the card. When a workman quits, the leaving items are added to the card. Form 167 is thus made to record all that the factory deems of importance in regard to every workman. The file of forms 167 is examined in all cases of application for employment.

This factory has no card of workmen's rules whatever: the shop pace is fast, and the shop routine is thoroughly established, and the worker who finds himself falling below the standard of requirements seldom waits for his discharge, but leaves of his own volition.

There is no assembly hall connected with the Link-Belt shops, but the openness of the main machine shop, owing to individual-tool-motor driving and the consequent absence of belts and counter shafts, makes it possible to use camp chairs and seat an audience of 500 or 600 persons in easy reach of one speaker's voice on the main shop floor; and winter evening lectures, illustrated by lantern slides, free to employees and their families and friends, have a very full attendance; the topics chosen for these evening entertainments are varied, and general in character.

Discharge, suspension, or leaving of workmen is recorded on form 138½, and, if due to the action of a foreman, is investigated and approved by the superintendent before the change becomes final. Peremptory discharge is rare, and is regarded as regrettable, it being the policy of the factory to install good men only, and to keep them after service once begins. Every workman is made to feel that his services are valued at their full worth, and this consciousness of esteem produces a willingness to co-operate with the management in its efforts to obtain a high hour production in all departments. The men do not feel that they are driven, but rather that they are helping the managers to drive the work, and that their individual efforts are of the highest value, which is indeed, the true condition of things. The extreme willingness of all the workmen forces itself on the experienced observer's attention, as the vital characteristic of this establishment.

There is a mutual benefit association among the workmen, purely voluntary, which has a large membership, and is fostered

by the management. Beyond this the establishment does not favor paternalism, nor alms-giving, although temporary aid is freely and even generously given in misfortune.

While this brief sketch of the policy of this factory regarding its workers does not fall strictly within the lines of factory accounting, it is nevertheless of deep interest to all students of factory economics, and is therefore appropriately given in these pages, which are written with a view to industrial betterments at large.

Forms 138½, 139 and 167 well cover all factory requirements for information regarding employees.

STORES.

The Link-Belt Engineering Co., is distinctively and broadly an engineering concern, confining its manufacturing to such components and structures as it cannot procure to its satisfaction from other makers. The finished productions of other manufacturers are to a large extent its raw materials.

In order of importance these rough stores are: (1) chains, including "Detachable Link Belting," "Dodge Chain," "Mono-bar Chain," "Renold Silent Chain," and other chain forms made by the Ewart Manufacturing Co., of Indianapolis, and carried in complete stock by the Link-Belt works. (2) Sprocket wheels and other grey-iron components produced in a foundry, which, though an independent concern, is treated, so far as the cost-keeping is concerned, as a Link-Belt factory department, orders being placed by use of form 28, production order. (3) Steel, in bars, plates, and special forms. (4) General stores. All the different items of storeroom stock are requisitioned into the factory departments and shipping room by various forms adapted to various uses, as hereafter shown.

STORES RECEIVING AND DISBURSEMENT.

All stores are in charge of one storekeeper, whose office is at the rear left side of the factory on the lower level. The chain and wheel and wrought-shop finished product of standard buckets and attachments are stored toward the factory front on the lower level floor, even with the driveway, and extending under the whole length of the main factory floor. The wrought-shop

rough stores are kept in a storeroom to the rear and left, with a wagon-way across it and a railway track inside lengthwise, so as to permit unloading of sheets and rails directly from the railway cars into the storeroom piles. All stores records are kept in a card-index open-tray file in the storekeeper's office.

Stores are delivered to both the wrought shop and machine shop mainly on production orders, form 28. The storekeeper is furnished with complete duplicates of all production orders, and sends all material to departments as required, using his force of laborers to tag, stamp and mark each individual piece which requires finishing, or each finished component or lot of components, and to deliver them to the most convenient places in the departments for the operations demanded.

COLOR SCHEME OF COMPONENT TAGS.

Production orders, form 28, specify time and manner of shipment, and the designating and identifying of the respective order components is very largely made by tags in three colors and of two materials, so that at first sight, without even reading the legends borne by the tags, the department foreman can know what first demands attention.

Vivid green is the emergency color, and a green tag gives a component first place in factory operations, which must begin immediately upon the reception by a department of a green-tagged article.

Terra cotta color signifies "Ship by express," and articles tagged with terra-cotta-colored tags take rank in work consideration next below the green-tagged components.

Plain manila tags are used for work which is to go through the department in ordinary course, and be shipped merely on its recorded delivery date.

By this color scheme instant information of emergency orders is given to all interested, as soon as the component is visible.

Paper tags are used for components going to factory departments. For delivery to outside erection engineer gangs the component is tagged with a white linen tag, which resists moisture and has great wear endurance.

These variations in component tag colors and materials greatly aid factory operations, because even a mere glimpse of

the tag informs both foremen and workmen of the requirements of the instant, and the order in which pieces are to be worked.

DEPARTMENT OPERATIONS.

Upon receipt of the ordered material in a department, it is first examined, and if found unfit is replaced by use of the "Damage Report," form 27, which see. If fit, the time clerk makes out the individual time cards for the component, using as may be, form 4, white, form 4, blue, form 59, white or form 59, blue, which see. These time-card forms cover all the machine-shop labor operations.

Wrought-shop work is always done by a gang of two or more men working together, and gang labor on components is recorded on form 79, white, and form 79, blue.

Separate time cards are made for each individual workman's operations on each component, and some of the piece-rate operation cards are for very short times, operations requiring only $1\frac{3}{4}$ minutes of working time being separated and noted on the cards in one observed instance.

INSTALLATION OF THE LINK-BELT COST SYSTEM, AND ITS DEVELOPMENT.

For the underlying principles and the general lines of their cost-keeping practice, the Link-Belt Engineering Company give credit to Mr. Fred. W. Taylor, who has inspired much of the best work looking to advancement of shop economics. The first forms used by the Link-Belt Company in cost-keeping were devised on general lines recognizing the necessity of collecting cost items in minute detail, and producing such forms as would not only facilitate, but ensure the daily writing of those indispensable records of small performances, which must be recorded each day if they are ever to be obtained. These original forms were, of course, tentative only, and some of them have been greatly modified, but the broad underlying idea of resolving costs into their ultimate items of individual labor operation times, has never been lost sight of, nor set aside in any instance; no matter how short the time required for executing an operation, there is a separation of that time in the accounting, if the operation itself is a distinct and separate step in the factory production. The most interesting

feature of the modification of the original Taylor forms is the changes made in the "Order Cost Sheet" which records the costs of each production order. The title "Production Order," is not used in this system of cost-finding, the form which authorizes and originates a factory product being made on form 109, original, and copied on form 106, for use in factory departments, and called a "Bill of Material."

Form 106 is filled so as to give explicit working directions to all heads of factory departments taking part in the order production, without any verbal instructions whatever, and appears to have been a satisfactory instrument from the first: all that is needed in the production order is space enough, and the filling of this space with unmistakable specifications of the component parts of the product expected; and as this Bill of Material, form 106, is a sheet of good size, and as many sheets as desired may be used for the specifications of a single order, 200 of these large sheets being sometimes filled under one order number, nothing short of stupidity or carelessness can make it bad.

The order production costs are recorded on form 130, "Daily Wages Cost Sheet," and it is the evolution of this form 130 which is the peculiarly interesting development in the history of this cost system, because it shows in its now obsolete first and second wordings, in obsolete forms 32 and 111, an intention to recognize the difference in cost to the factory of hours of productive labor using different plant values, and so aiding a correct expense distribution.

Each operative is provided with a time card bearing the order number for each order production operation he is to perform during the day; the succeeding morning these time cards reach the cost department, and all the labor-hour costs, made up of time multiplied by rate, are entered on the cost sheet bearing the order number. But when this bare flat-cost charge is made, there is yet a large unrepresented cost to the factory, in the way of plant use, which is not, so far, charged to the production of the order, although the expenditure has been made by the factory. If every worker used identically the same value of plant, and occupied the same factory floor space, and used the same fraction of the factory driving power, then there might be a fairly correct factory expense increment added to the product of labor hours by

rate, so that the cost sheet daily charges would closely approach the real labor-hour factory costs. But the operatives use vastly differing plant values: a vise hand may be working at a wage-rate of 30 cents per hour, using a \$10 vise, and a \$5 kit of files, and 30 square feet of factory floor space, while his shopmate on a large boring mill or lathe or planer, working at the same hour-wage, may use plant valued at \$3,000, 400 square feet of factory floor, and three or four horse power of factory motive energy. In such a case the vise hand might not cost the factory more than 40 cents per hour, cash and plant charges together, while his fellow craftsman using the large machine tool might cost the factory \$1.60 or \$2 per work-hour, one four or five times as much as the other.

Here the question comes into every cost-keeper's mind, as to how this difference in factory cost of the labor hours of different workmen, outside of the hour-wage rate difference, shall be ascertained, and when and where and how this very great difference shall be noted and adjusted. Shall all the factory expenses outside of labor-hours multiplied by hour-wage rates be lumped as expense and divided among the whole total of hours' labor performed, or shall each man's great or small use of factory plant value and running costs be recognized individually?

The whole trend of the mind of a cost-keeper who would recognize factory operations of so little as 105 seconds in time duration as a cost-finding unit, to be separately noted and individually treated in the cost-keeper's calculations, must have been toward accurate expense apportionment, and against any lump-sum, hit-or-miss, make-one-hand-wash-the-other procedure of any sort, and the first "Order-Cost" form, form 32, now obsolete, for recording daily order costs, shows a determined attempt to make labor-hour cost records at their actual cash cost to the factory appear on the obsolete flat cost record, form 32. Here the form is headed, not "Wages" Sheet, merely, but "Order Cost" Sheet, which is a very different thing. The first space of this obsolete form 32, which see, takes the order mark, number or symbol. Then follows a piece description space, 12 date spaces, making each of the 8 horizontal divisions of form 32 record 12 days of one workman's time, or 96 days of time total, on a sheet 14 inches long by 17 inches high, or 238 square inches. The

items recorded were: mark and description of production, date of labor, number of pieces, labor hours, labor cost in cash at hour-rate, TOOL TIME, TOOL COST, and shop number of the tool, so that the tool could be identified.

Here was evidently the intention of correct factory expense apportionment. What was ever discovered by its use cannot now be ascertained. This form 32 was used for a number of years, but the "tool-cost" spaces came not to be filled, and no trace of their effect or value remains.

Then obsolete form 32 was changed to obsolete form III. The size of sheet was changed to 10½ inches high by 17 inches long, or 178½ square inches, as against the 238 square inches area of the discarded form 32. Form III had horizontal divisions for 6 workmen's times, 14 day's records to each man, or 84 days total, and it also dropped the unused item spaces for "tool time" and "tool cost"; but it kept the "tool number," rather oddly, since nothing could be added to cost-finding accuracy by simply recording the tool used, without making any dollars-and-cents' use of the record.

About eight years since, Mr. Conrad N. Lauer was placed in charge of the Link-Belt cost-finding, and some time after his installation came a demand from the management for costs in total to date on any order at any time, whether the order was completed or incomplete.

In response to this demand Mr. Lauer prepared a thesis and presented it to the management for consideration, in which he pointed out the impossibility of giving costs sooner than one week after production, for the following reasons, directly attributable to the form of Order Cost Sheet III, now obsolete.

Mr. Lauer's thesis said, in part: "After a copy of a Bill of Material is received from the engineering department, the first step toward obtaining detailed costs is to write cost sheets, form III, giving each particular component in the Bill of Material one space or more, as in the judgment of the clerk may be required for its cost record. After this is done there can be no more work on this cost until at least one week's time cards have reached the cost-keeper's office. This delay is caused as follows: The morning of the day following the date of the time card, the time clerks record upon the bills of material and on all regu-

lar orders the number of pieces and the operations on each finished for that date; they then separate each workman's cards, and, after ascertaining that he has time cards for the number of hours noted for each workman, pass the cards to the paymaster, who, in turn, examines them for correctness and for piece work. The paymaster after having made all necessary calculations, and having also made his pay-roll entries, in turn passes them on to another clerk, who makes a distribution of each man's time to the various orders, as required by the treasurer. These distribution sheets check the pay roll, as the labor totals of the two records must balance; hence it becomes needful to keep each day's time cards for each man in exactly the same condition as when they first came from the time clerk, for should any error be suspected it would be a very difficult and costly matter to find any particular workman's time cards after they had been sorted to different orders and filed in their respective places.

"After the distribution clerk has balanced his weekly total of distributed labor hours with the total labor hours of the pay roll for the week, he can then multiply hours by rate, and place a wages-cost total on each time card, and when this is done and not until then, at least past one week end from the time of labor performance, can the cost clerk arrange the time cards so as to be of use to him in making his costs.

* * * * * * * *

"This method of making costs has at least four serious disadvantages, as follows:

"1st. It is necessary to rewrite all bills of material on which costs are asked for, which calls for a large amount of work;

"2d. The method of making entries is slow because of the numerous details;

"3d. The work is great and very slow;

"4th. Last and greatest fault, the costs must always be at least one week behind the labor date, and it is therefore impossible to ascertain costs to date, whenever asked, without a great amount of slow and tedious work.

"The other method of making costs, now in use at the works, known as the 'Bill of Material Cost Sheet' method, was put into use by me about three years ago. By the use of this method it is not necessary to rewrite the bill of material, as that is used

for the cost sheets, as shown on form 106. The procedure is as follows: the cost clerk commences to enter his material costs, as soon as may be, on the right-hand margin of the bill of material, form 106. After all his material costs are entered and totaled, he must wait until the order is completed before he can enter any wages cost, for he has no spaces in which to record these costs individually, because there is only one line for each bill of material component. After the order is completed, then the total labor time is entered in the single space allotted to labor cost, and then the labor and material costs can be added and the total component cost can be found.

"This system has the advantage of not requiring the re-writing of the bill of material, but it does not contain a current day-to-day labor-cost record, and cannot contain such a record, because it has no spaces to receive such entries.

"An efficient cost system must show more than the mere cost of totals after completion; it must tell the cost of each component from day to day as the work progresses, and so inform the superintendent as to what cost has been made at any time. If the superintendent can have this cost to date at any time when he asks for it, he can in almost every case, hold work cost within the estimated total, if not bring it considerably below.

'A system giving current costs will also be of great convenience to the engineering department in case of alterations being found desirable before the completion of an order, as it will tell what unexpended balance of the contract order cost yet remains, and so help to keep the final cost within estimated limits. The book-keeping department will also be greatly the gainer by having costs at their disposal as soon as an expenditure is made.

* * * * *

"For these reasons I would declare form 111 obsolete, and in its place I would substitute the Daily Wages Cost Sheet, form 130. The bill of material, form 106, has 25 lines for items, and on this daily wages cost sheet, form 130, I have allowed 24 corresponding line spaces, which is enough, as the items of collars, pillow blocks and other 'regular' components on which we have standard costs, will save more than one line space in every 25 lines of bill-of-material space.

"The added work for the cost clerk caused by the use of

form 130, will be filling in the date and headings, and the entering of bill-of-material marks on each space. The form 130 is then ready to take current entries as follows: After the time clerks have sorted the time cards and made daily work check entries, the time cards will be sent to the cost clerk, who will make the hours and wages entries on this daily wages cost sheet, form 130, and then put the time cards in shape and pass them to the paymaster.

"It will be observed that each space has 20 lines, giving room for 20 daily-wage entries; this in almost all cases will be sufficient, even where all the bill-of-material spaces are filled. In wrought-iron work, where a completed unit, such as an elevator casing, hopper, or the like, is made up of several components, each bearing individual order marks, one entry on the daily wages cost sheet, as 'B-1 to B-70, inc.,' will suffice. Such conditions frequently occur, and I think it of interest to mention that a single daily wages cost sheet, form 130, will often be sufficient for two or three bill-of-material sheets.

"This daily wages cost sheet, form 130, will give costs to date at any time, by simply adding the labor totals on form 130 to the material costs charged against the work in question on the bill-of-material margin.

"Proposed form 130 will give all cost details needed for accurate billing.

"If the cost clerk is notified at the beginning of work on an order that current costs may be required, then he can make all his labor entries against that order number on the day following the labor performance, and total labor and material costs on the order can be given promptly and with very little clerical labor whenever asked.

"I would offer two additional suggestions in regard to the treatment of 'Materials Purchased' records. We now write up what we call a 'Material Book'; I have divided this book page into two divisions, and headed them 'Ordered' and 'Billed.'

"In place of this book I would suggest a triplicate form of purchasing order, by the use of which, bound in some cheap form of binder, the orders will become a book in which all billing may be recorded for cost purposes, and the work now done on the 'Ordered' page of the 'Material Book' may be avoided.

"The other suggestion is in reference to time cards: I would have cards of different colors for piece work and for day work—blue for day work and white for piece work."

Mr. Lauer's suggestions for the triplicate Purchasing Order, form 107, and for the different colors of time cards, were adopted, as was also his daily wages cost sheet, form 130. With the adoption of form 130, the last vestige of the original attempt to make the labor costs of each workman's time proportionate to his use of floor space and plant value and motive power was discarded. Form 111 was put away forever, and in place of 6 lines of 14 time record spaces each, a total of only 6 times 14, or 84, time spaces, the replacing form 130 has, on a sheet of the same size as form 111, 240 time record spaces, and gives current costs, which could not be recorded at all on form 111.

It is interesting to note the lingering death of this hope for correct expense distribution, as exhibited by the full list of cost-item titles on form 32, which was used for some years with approval, the omission of part of these enlightening titles on the succeeding obsolete form 111, which also had a considerable period of use, and the final dropping of all enlightening titles and all attempts to collect more than the bare date, hours and wage-rate of labor, as production-cost labor charges against any individual order number, as shown by the daily wages cost sheet, form 130, now in use. Unquestionably, the great convenience of having all the component labor costs on one Bill of Material, which is the name given to the production order in the Link-Belt cost system nomenclature, is of far more real practical advantage than the information hoped for from the use of obsolete forms 32 and 111, even if they had been rigorously filled, and if their records had been carefully analyzed and apportioned by the cost-keeper in his desperate effort to reach perfection in expense distribution. Here was the conception of an elaborate refinement in cost-finding, never carried out, never in the least filling its intended office, and yet cherished and given room sorely needed for much more profitable tenants year after year, simply because it had once been an iridescent ideal, and its bow of promise, though it proved a false prophecy, could not be sooner effaced.

TIME CARDS AND PIECE-RATE CARDS.

This company pays labor in three different ways: Plain day pay, single workman piece-rate, and gang piece-rate. These rates affect the forms of the time cards, which are 4, white; 4, blue; 59, white; 59, blue; 79, white; 79, blue; 84, white, and 152, yellow.

The first form of labor pay is the fixed hour rate. Every day worker has his individual hour-wage rate.

The second form of labor pay is the single workman piece-rate, which is a "premium" rate always. If the work is finished inside the time fixed by the rate-fixer for the operation, then the workman obtains the high rate of pay; if the workman does not finish the job inside of the rate-fixer's time, then the workman is paid the low rate only. In no case does a workman have less than his fixed hour-rate for his work; he may obtain more than his hour-rate by making his production time fall inside the rate-fixer's time, but he is not penalized if he exceeds that time. The rate is fixed on operations of as little as $1\frac{3}{4}$ minutes' duration, which manifestly makes it impossible to write separate labor-cost items in details. To meet this difficulty, the piece worker is given a time card for each separate operation or job he performs, and his total time of labor is taken from the time-recorder sheet. At the day's end, the total minutes of piece-rate time on work done by the individual is compared with the total minutes of his working hours for the day. If the rate time exceeds the actual time, then the workman is assumed to have finished each and every one of the jobs done in that day inside of the fixed time rates, and is paid the extra rate on his whole time for the day. But if the actual working time exceeds the total of the short-time rates on all the jobs done, then the piece worker is paid the ordinary or "low" piece-rate for work done, or else his day-rate. For miscellaneous piece-rate work see time card, form 4, white. This is the normal, or regular Link-Belt time card, the intention being to perform all regular operations at piece-rates, with premium incentive, as explained.

It is not possible, however, to fix time production rates on all the work done in a factory which has a continually varying product, so this establishment has considerable work done at day-

rates, for which workmen's time cards are made on form 4, blue, which is the same as form 4, white, except for the omission of the piece-rate and premium-rate lines.

In the wrought shop, much of the work is done by gangs of men under a gang foreman. In this case the single piece-rate only is fixed by the rate-fixer, and there is no premium, and if the men fail to win day pay at the piece-rate, the factory stands the loss, and the men are paid full time, the same as if working at plain day-wage rates. If the gang is speedy and has good luck, and the piece-rate for its completed product exceeds the combined time-rate for the gang, then the excess is divided among the gang individuals in proportion to their individual day-pay rates, and the number of hours worked by each, so that, for example, a 40-cent-an-hour gang foreman gets twice as much of the excess as the 20-cent gang-worker. The gang foreman is really a contractor, but he does not get all the profits over the gang day-pay, as did the contractor under the old shop contracting practice, where the contractor hired and discharged his own men, and took everything for himself that was left after his workmen had been paid at fixed hour-rates. This Link-Belt pro-rata division of gang piece-rate gains seems to be fair and equitable, as the higher-priced men are the more skillful and are the principal gain-producing factors. The gang piece-rate contract is made on form 79, white. The "From" and "To" columns of the gang time record are for use where, as on a riveting machine, the same gang may do work on several orders in one day, and the beginning and ending times of work on jobs require record.

Form 79, blue, is the wrought-shop gang time card for day rates; on this the piece-rate record space is omitted. Otherwise, form 79, blue, is the same as form 79, white.

For convenience chain sprocket wheels are treated in a class by themselves.

Time cards 59, white, piece-rate and premium, and 59, blue, day-rate, are issued for wheels alone. These forms have spaces for the specification of wheel particulars and as the component tag which is attached to each rough wheel delivered for finishing bears the same specification, machine-shop mistakes should not occur.

Form 84 is the field-work or erection-work gang time card, filled by the erecting engineer in charge. See also form 112.

Form 105 is a piece-rate, establishing notification from the rate-fixer to the department foreman concerned. Form 152 is the draftsman's time card.

Thus this cost-finding system employs no less than eight separate and distinct forms for recording the labor performances of its various workmen. The time cards for the previous day are in the cost clerk's hands the first thing every morning, and as each operation on each production order is made under its own special time cards, all that need be done to obtain all costs on any order in course of production is to gather the cards according to their order numbers, and charge the labor costs on the daily wages cost sheet, form 130, totals from which give costs in any required division or total.

Efforts have been made by various cost-keepers to devise usable forms of multiple or universal time cards, so that a single time card form could be made to cover all the various time-record requirements of a varied-production factory. The Link-Belt practice is diametrically opposed to anything of this combination or omnibus sort in the way of time records, and declares emphatically in favor of a distinctive time card for each separate form of production labor.

In the cost-keeper's office all time cards are gathered by their order charge numbers, have their records transferred to proper spaces in the daily wages cost sheet, and are then bundled and filed in cabinets for future reference.

The use of differently colored time cards and time records is advantageous, as leading to instant recognition of a card's function without reading its inscription; and the whole scheme of the Link-Belt time records is worthy of close attention, because it is in highly successful use, and because it has been of slow growth, and is the outcome of many experiments.

CHAPTER IV

THE FORMS OF THE

LINK-BELT ENGINEERING COMPANY.

Form 1. Regular pattern production order. Size, $5\frac{1}{2}$ inches long by $7\frac{3}{4}$ inches high; medium weight, light yellow paper.

Form 1 is filled in the engineering department and signed by the assistant chief engineer. This production order then goes to the pattern shop, and the pattern is made.

The pattern having been produced and approved, form 1 then goes to the cost clerk, by whom the workmen's time is charged in spaces designated from the pattern-maker's time cards filled by the machine-shop time clerk. Pattern material items for wood patterns are entered on the pattern-maker's time cards. For metal patterns, the material is recorded on manuscript foundry slips, all castings entering the factory being accompanied by these slips made out by the foundry and sent by the receiving clerk to the cost clerk. From these vouchers, as may be, the cost clerk fills the pattern cost spaces on this form 1, and totals the charges for the pattern cost, which is flat.

The "class" space at the bottom tells to which of four classes the pattern belongs:

Class 1. Standard patterns, which may be either of wood or metal.

Class 2. Special patterns.

Class 3. Link-Belt standard.

Class 4. Special patterns for using only once and which have no inventory value.

The class number is applied to the order by the assistant engineer, when the order is made, and informs the pattern foreman as to the quality of workmanship and product demanded.

The pattern symbol, which is always a number, never a letter, is applied to the pattern in the pattern shop, and is registered

FORM I

PATTERN ORDER.

ORDER NO. _____ 1 _____

Make Pattern No. _____ Drawing No. _____

Number Castgs. Wanted, _____ Date Castings Wanted, _____

Description, _____

_____Charge to _____ Signed, _____

Pattern Maker, _____ Time, _____

" " " "

" " " "

Material Used, _____
_____Approved by P.S. _____ Entered by D.R. _____

Cost, Labor, _____

" Lumber, _____

" Iron or Brass, _____

" Sundries, _____

CLASS, _____

Total,

in the pattern register book, kept in the engineering department, when this blank is first filled.

Form 4

TIME CARD.

MISCELLANEOUS.

Machine Shop _____ 1

Name _____

Machine _____ No. _____

Order _____

No. of pcs. fin'd _____ No. of pcs. ordered _____

Name of Piece _____

Size _____

Mark _____ Pat. No. _____

Drawing No. _____

Rate _____ per _____ Extra Rate _____ per _____

If done in _____ hrs., _____ mins. per _____

Time Started _____ Time _____

Time Finished _____ Wages _____

FORM 4. MISCELLANEOUS TIME CARD.

Form 4. Miscellaneous time card. Size, 3¼ inches long by 5½ inches high; medium weight; white.

A separate time card is made by the time clerk for each sepa-

[illegible]

FORM 7. WROUGHT-SHOP GANG TIME CARD.

rate article, or for each separate lot of articles designated by the same symbol or mark.

The white card is the piece-rate card, white and manila colors indicating regular operations, which are intended always to have piece-rates made for them by the rate fixer.

Form 4. Miscellaneous time card. Size, $3\frac{1}{4}$ inches long by $5\frac{1}{2}$ inches high; medium weight; blue. Not engraved.

Day-rate time card, for special operations. Same general form as white time card, but without rate titles. Separate cards are made by the time clerk and issued to workmen for each separate article, or lot of articles designated by the same mark or symbol.

Form 12

Order No. _____

Date _____

Traction Sprocket Wheel _____

Diameter _____ Teeth _____

No. of Belt _____

Bore _____

Core _____

Keyway _____

Set Screw _____

Weight _____

Hubs _____

Must Ship _____

Remarks: _____

FORM 12. WHEEL TAG.

Form 7. Gang time card. Size, $3\frac{1}{4}$ inches long by $5\frac{1}{2}$ inches high; medium weight; blue.

This card is used for gang day-rate work in the wrought shop, and is filled by the time clerk. A separate card is made for each piece, or each lot of pieces bearing the same mark or symbol.

Form 12. Wheel tag, $2\frac{1}{8}$ inches long, by $3\frac{1}{4}$ inches high; yellow.

Filled and attached to the wheel by the receiving clerk, when the rough casting is received from the foundry, and sent direct to the shipping room. The receiving clerk fills this tag from the bill of material as soon as the latter is received by him, and holds the tag until he has the wheel casting. The yellow color signifies "Ship in the rough." After the shipping clerk has prepared the



rough wheel for shipment this shop-identification yellow tag is removed and destroyed.

Form 12. Green; same as foregoing form 12, except that the green color marks an emergency order, which must take precedence in factory operations and be shipped by quickest route regardless of all else. Not engraved.

Form 12. Terra-cotta color, signifying "Finish rapidly, ship by express." The terra-cotta tag gives the component place before everything not bearing a green tag. Same, except color, as form 12 first described. Not engraved.

Form 12. Manila, signifying regular course in shop operations and shipment. The same as form 12 first described, except color. Not engraved.

FORM 15

Order No.

Customer's }
Order No. }

Bill of Material, }
Sheet No. }

Mark

Where Used

LINK-BELT ENGINEERING CO.

FORM 15. TAG FOR OUTSIDE USE.

Form 15. White linen. This is a component identification tag, the same size as form 12, and by its color and material denotes a field or outside erection component. This card is extremely durable, hence its use for out-of-factory identification.

Form 26. Requisition on the Tioga Foundry for grey-iron material not authorized by any regular "bill of material" or production order. Size, 6¼ inches long by 7 15-16 inches high; white.

With this full printed white order is a pink sheet of the same size, bearing only the words "Tioga Foundry Company." Form 26 is filled by the stores clerk, and sent by him to the Tioga Foundry. The pink duplicate is filled in carbon copy when the

white form 26 is filled by the stores clerk, and is filed in the storeroom until the castings ordered are received from the foundry, and checked on the pink duplicate to the proper factory de-

[illegible]

FORM 26. REQUISITION ON FOUNDRY.

partments. After the castings have been sent where they belong, the pink duplicate, form 26, is destroyed.

This is a case of providing two different forms and methods for effecting the one result of procuring grey-iron castings, one

regular by the use of form 106, bill of material, and the other by the use of this form 26, which does not emanate from the engineering department, but is filled at a moment's notice by the storeroom clerk, as occasion may require.

Form 27. Damage report. Size, $3\frac{1}{8}$ inches by 5 9-16 inches; light weight, pale yellow.

This is a "waster" or "faulty material" replacement form.

In case material inspected into the factory as available proves defective, or becomes a waster through errors in machining, or in any other way has to be replaced by a similar piece, this form 27 is filled by the department foreman or his assistant in duplicate, carbon copy, one copy going to the source of production and acting as a replacement order, while the other goes to the

Form 27	DAMAGE REPORT.	Date, _____ 190__								
	The following material on _____	Order No. _____	by _____	Cause, _____	To repair damage it will be necessary to _____			Signed, _____		

FORM 27. DAMAGE REPORT.

cost clerk, who is thus informed of the cause of the double material charge.

Form 28. Front. Regular factory production order. Size, $7\frac{1}{4}$ inches long by $8\frac{1}{2}$ inches high. Heavy paper; white.

This is issued for all orders for factory product of all kinds and descriptions. In some cases the order is filled from finished stores, in some cases factory department labor is required to fill the order, and in other cases engineering or inventing must precede the factory labor operations. If "engineering" is demanded this fact is specified on this production order form.

FORM 28
FRONT

LINK-BELT ENGINEERING CO.

Date Entered _____ 19 _____ Date Shipped _____ 19 _____

Ship to _____

Via _____ to _____

Bill to _____

Quantity

Customer's Order

ORDER No. _____ Signed, _____

[illegible]

This form is filled by the order clerk from the customer's order, given by mail or word of mouth.

This form is printed in aniline purple copying ink, and written with the same ink, and will give 10 or 12 good copies by running through a copying press, leaving the original in good condition. This original is then sent to the shipping-room office, and copies are sent to each department having to do with the production demanded, an office and a shop copy being sent to both machine shop and wrought shop, two for each of these departments, one "office" copy and one "shop" copy. The daily labor completions are entered daily on the "office" copy. On the "shop" copies of the production order dated entries are made of the receipt of rough components from whatever source, and also of the delivery of finished components to the shipping room. The Link-Belt Co. does not operate a foundry, but buys its castings from the Tioga Foundry, a short trolley ride distant. A copy of each production order is sent to the Tioga Foundry, the same as if this outside concern were a factory department, and the foundry clerk goes to the Tioga Foundry every morning and sees that patterns and core boxes are on hand, and that hurry orders are in front. Order copies are sent to the foundry by the castings truck-driver, who constantly plies between the factory and the Tioga Foundry, and the foreman of the Tioga Foundry proceeds at once with castings, if he has the required patterns, without waiting for the presence of the foundry clerk. Patterns not known, by reference to card form 52, to be at the foundry, are sent there by the foundry clerk, as soon as may be after he has his copy of the production order.

If engineering is demanded before any factory production can begin, then the production order blank takes the order number, the customer's specification and a shop title, and is sent to the assistant chief engineer, who proceeds with the design and drawings of the new structure.

This same blank form 28 is used in making the "Y" production orders, which are stock orders for finished storeroom replenishment.

The "X" production orders, which authorize all shop-building alterations and additions and betterments rising above mere

Form 31

TOOL-ROOM REPORT.

Present this to Time Office in order to get your Wages.

189

*Registered No. _____ has returned,
in good order, all tools keys, etc., charged against
him.*

TOOL ROOM

MEMORANDUM FOR MERCHANDISE CREDIT.	
Received from _____ Via. _____	{ Date Rec'd _____ Credited _____
CHARGES. Freight _____ Cartage _____ Expressage _____	
HOW PACKED. 	

FORM 43. MEMORANDUM FOR MERCHANDISE CREDIT.

long by $4\frac{5}{8}$ inches high; heavy paper; stone color; printed in black.

Used for entry of material returned, to be placed to credit of customer returning the same. Filled by the receiving clerk, and delivered to the assistant treasurer.

Form 47. Department order on factory storeroom. Size, $5\frac{3}{4}$ inches long by $2\frac{5}{8}$ inches high; thin paper; light yellow color; printed in black.

Interdepartment requisition, used for repairs and such demands on factory stores as are not authorized by a regular bill of material or production order. Filled by any foreman or

Form 47		DEPT AND DATE.	LINK-BELT ENGINEERING CO. MATERIAL CARD.
MAKE BUT ONE ENTRY ON EACH CARD ORDERED OF STORES.	ORDER NO.		
		RECEIVED.	

FORM 47. DEPARTMENT ORDER ON STOREROOM.

assistant foreman, and sent to the cost clerk by the storekeeper after the requisition is filled.

Form 49. Storeroom stores index card. Size, 7 inches long by $4\frac{1}{2}$ inches wide; stiff card; white; black printing; red and blue ruling. Both sides alike.

Separate item materials, other than wheels, received and disbursed. Wheels have a similar "wheel" card. Printed alike on both sides. One side used for a single component only.

Filled by storekeeper and filed by him in card-index tray. The annual inventory is made from these cards. Some actual counts and inspection verifications of card-index balances of stores are made each year, the intention being to verify each card balance once in about two years. The card-index balances are accepted as correct. Actual counts show rare variations.

Form 52. Pattern locating and tracing card. Size, 4 11-16 inches long by 4 inches high; stiff card; white; printed all in black.

This is kept by the foundry clerk, in the stores and receiving room office, and chronologically filled and dated. This extremely useful and important card gives first the section of pattern storage-room shelving in which the pattern is kept, next the number of the shelf where it should be found, then the pat-

Form 52					
Sec. _____		Shelf _____		Patt. No. _____	
DESCRIPTION.				Draw. No. _____	
Wood _____			Iron _____		
DATE ISSUED	ISSUED TO	DATE RET'RN'D	DATE ISSUED	ISSUED TO	DATE RET'RN'D

FORM 52. PATTERN TRACING CARD.

tern number and number of the drawing from which the pattern was made; then comes a description-items and special-mention space; then material of pattern. Then follow 16 journey-record spaces, the latest date entry, showing the present location of pattern. This form is printed on one side only. The cost of the card would be but little more if the reverse were filled with journey-record entry spaces.

The use of this pattern tracer saves the time-wasting and

Form 53

ORDER TRACER

189

THE
LINK-BELT ENGINEERING CO.
NICETOWN, PHILADELPHIA

190

Gentlemen

On our order of _____ No _____

the following material is needed _____

Please note below when shipment will be made and return to

THE LINK-BELT ENGINEERING CO.
PURCHASING DEPARTMENT

annoying perplexities which occur when a pattern cannot be found where it is supposed to be, and is recommended.

Form 53. Order Tracer. Size, 6 inches long by 8½ inches high; light weight sheet; pale blue; printed in black.

This form is used when ordered material has not been received as expected at the factory.

Form 59. Wheel Time Card. Piece rates. Size, 3¼ inches long by 5½ inches high; light weight paper; white. Specific time card for wheels only. The white color denotes normal conditions and piece-rate work.

Form 59. Wheel Time Card, day-pay rates. Size, 3¼ inches

FORM 59 White	TIME CARD.		
	WHEELS.		
	Machine Shop, _____	190 _____	
	Name, _____	Machine, _____	No. _____
	Order, _____	No. of pcs. fin'd., _____	No. of pcs. ordered, _____
	Name of Wheel, _____	Diam., _____	No. Belt _____
	Bore, _____	Core, _____	
	Length of Bore, _____	No. of S. S., _____	Diam., _____
	Size Key Seat, _____	Drawing No., _____	
	Mark, _____	Pat. No., _____	
	Rate, _____ per _____	Extra Rate, _____ per _____	
	If done in _____ hrs.	mins. per _____	
	Time Started, _____	Time, _____	
	Time Finished, _____	Wages, _____	

FORM 59. WHEEL TIME CARD. PIECE RATES.

long by 5½ inches high; light-weight paper; blue. Specific time card, for wheels only. This is the same as form 59, white, except that "rate" lines are omitted. The blue color denotes abnormal performance in some particular. In this case it calls attention to the undesirable condition of work at day-pay rate instead of at piece rates, the piece rate being the regular form of labor recompense. Not engraved.

Form 61. Requisition. Size, 5 inches long by 7¾ inches high; medium weight paper; light yellow color; printed in black. This is the regular department requisition form, filled by the de-

Form 61.

REQUISITION

DEPT. _____ 190_____

To Secretary,

Please order for:

Signed, _____

Charge to _____ Deliver to _____

Must be in works

Approved, _____

partment foreman, and approved by the secretary, who is acting purchasing agent, and makes a corresponding order, from form 61 specifications, on outside source of supply, and after a time destroys form 61.

Form 79. Wrought-shop piece-rate gang time card. Size, 3¼ inches long by 5½ inches high; medium-weight white paper; printed in black.

Normal conditions, gang piece-rate time card for wrought-shop work. A separate card is made for each separate production order number.

[illegible]

FORM 79. WROUGHT-SHOP GANG TIME CARD. PIECE RATES.

Form 81. Office Order. Size, 7 inches by 8½ inches; printed in black on medium-weight manila paper. Verbal order record. Filled in pencil by the order clerk from the customer's verbal order, and signed by such customer, and placed on file as a certified memorandum, from which the order clerk subsequently makes the formal order for production on form 28, which see.

Form 83. Wheels card-index form. Size, 7 inches long by 4 $\frac{5}{8}$ inches wide; stiff card; white; printed in black. Ruled in red and blue. Same on both sides.

Card-index record card for inventory and current record of wheels, either rough or finished, on hand in factory storeroom. Filled by storekeeper, and kept by him in tray in storekeeper's

office. The column headings "S. S." and "K. S.," mean "set screw" and "key seat," and if the wheel is finished, the diameter of the set screw or the key seat dimensions are entered on the

Form
81

OFFICE ORDER.

LINK-BELT ENGINEERING CO.

Send to

Ship via

Terms

Bill to

Issued by

Signed

FORM 81. OFFICE ORDER.

card. The space following the word "Rack," above the word "Wheels" in upper left corner, is filled with the number of the consecutively numbered store-room wheel rack, where the wheel may be found.

LINK-BELT FORMS.

63

[illegible]

FORM 83. WHEEL CAR INDEX.

Form 84. Outside time sheet. Two sizes, $8\frac{1}{2}$ inches and $7\frac{1}{4}$ inches long by $9\frac{1}{4}$ inches high; medium-weight paper; white; printed in black; ruled in red and blue. This form has about three times as many horizontal lines as are shown in the engraving.

This form is filled by the superintending engineer in the field, or outside, approved by the chief engineer of the factory and sent to the paymaster, who fills out form 112 with the corresponding items, and sends filled form 112 to the assistant treasurer, who fills the workman's pay envelope accordingly if the workman is to be paid at the factory. If the workman is to be paid outside of the factory, then this form 112 is sent to the superintending engineer in the field, with check to cover. Form 84 is finally filed in the cost department, as a job cost voucher.

Form 87. Wrought-shop piece-rate specification of factory contract with workmen for construction. Size, $8\frac{1}{4}$ inches long by $12\frac{1}{2}$ inches wide; medium-weight, white sheet, without printing; ruled in red and blue. This form has about forty horizontal lines, only eleven of which are shown.

This form is filled by the paymaster, and is a specific wrought-shop piece-rate contract form, which bears at the head the special contract terms made with an individual workman, who may, however, call to his aid others, commonly laborers, whose labor hours are noted on the form spaces.

The piece rate must pay all hands, both contractor and the auxiliary labor, the total rate division being made by the paymaster, on a pro-rata scale determined by the day-pay hour rate of the various workmen assisting in the production.

Nearly all the wrought-shop work is at piece-work rates.

Form 89. Factory notification of shipment of merchandise. Size, $8\frac{3}{8}$ inches long by 11 inches high; light-weight sheet; yellow color; printed in black; ruled in red and blue. See also production order, form 28.

This form 89 comes into use after goods are shipped, and has the left hand part of the top portion filled by the bill clerk, who sends this form, thus partially filled, to the cost department. The cost clerk then fills the lower part of form 89 with detail items of labor, time and material, with expense account apportionments, for each component of the order, thus giving the

total manufacturing cost of each component, using both sides of the lower part of this form 89 for these entries, if necessary.

Form 89, still entire, then goes to the treasurer, who adds the profit percentages to each component manufacturing cost, and enters the selling prices thus obtained in the dollars-and-cents spaces at the right hand of the upper part of form 89, against the component designations first filled in by the bill clerk, the treasurer merely determining the selling prices and entering these prices only, on form 89.

The treasurer then separates the two parts of form 89 at the black dividing line, and returns the upper half to the bill clerk, and files the lower portion in his own office.

Form 89, by the procedure detailed, secures the following effects:

The bill clerk notifies the cost department of shipment of certain merchandise components; the cost department specifies the manufacturing cost of each component shipped; and the treasurer adds to these costs the factory profit, and returns the selling prices of each component to the bill clerk, and keeps the lower section record of manufacturing cost of components in his own office.

This form 89 is an evident necessity, as there must be some notification from the shipping department and bill clerk to the financial department, announcing the sending out of merchandise so as to ensure the presentation of a correctly priced bill of charges to the customer who buys this merchandise, and this notification of shipment should be of such scope and capacity as to cover all forms of merchandise shipments, from the smallest to the largest. For this reason notification form 89, is given considerable recording surface, so that it takes a detail of the individual components of a large class of shipments of merchandise, the factory production of which is authorized on form 28, which is the general production-order form. But where engineering or inventing is needful to fill an order, this production-order form 28 is often not large enough to contain full specifications of components, and so is supplemented by the bill of material, form 106, which has large description space, and may be made to have any needed surface by using as many sheets of form 106 as may be required. In point of actual practice, as many as 200 sheets of

form 106 have been needed to specify the components of a single order.

Where there are such large numbers of components, a complete transcript would be costly, and would serve no useful purpose, as all needed information is recorded on the form-106 sheets, which do not leave the factory.

Therefore, where the production order, form 28, is supplemented by a sheet or sheets of the bill of material, form 106, the notification of shipment, form 89, is filled by the bill clerk by simply writing the bill of material number in the upper left

Form 97

LINK BELT ENGINEERING CO.

Watchman·

Pass Mr. _____

to our works on _____

FORM 97. NIGHT PASS.

hand division of form 89, which is then sent to the cost-keeper as previously specified. The cost-keeper then sends form 89 with the bill of material sheets, form 106, belonging thereto, to the treasurer, as before, the manufacturing costs of all components being previously recorded on the bill of material sheet or sheets by the cost clerk; the treasurer then treats the shipment record as before detailed.

Departmental secrecy is secured by this use of form 89. The billing clerk is informed of the selling price only, and the cost clerk is not informed as to the factory profits, which are fixed by the treasurer, who retains in his own department the

not to be made public. Each department is thus given all the

[illegible]

FORM 99. STOREROOM RECEIPT.

information needful for the performance of its proper functions,
and no more.

Form 89 also secures its intended effects with the least possible clerical labor, and imposes the least possible labor on the

treasurer, who has merely to add the profit percentage to the manufacturing cost totals which are filled in on form 89, before it goes to the treasurer's office, and to extend the selling prices in the right hand dollars-and-cents columns of the upper part of the form, which is sent to the bill clerk.

This form is worthy of special attention.

Form 97. Visitor's night pass. Size, $4\frac{1}{2}$ inches long by $2\frac{3}{4}$ inches wide; medium weight; white; black printing.

Must be presented by any one desiring to pass watchman out of business hours. Made out by some executive officer of the company.

Form 99. Storeroom receipt. Size, $6\frac{1}{4}$ inches long by $7\frac{7}{8}$ inches high; bond paper; printed in black; red and blue ruling.

Form 103

Order No.

Mark

Quan.

Patt.

Size

Description

Must Ship

FORM 103. COMPONENT TAG.

Form of receipt for material received by stores clerk at storeroom on verbal order, or sent in, unordered, for sample, trial or inspection. Made in carbon duplicate, and sent with the material to the proper factory department.

Form 103. Component tag. Size, $2\frac{1}{8}$ inches long by $4\frac{1}{4}$ inches high. Stiff paper; green. Printed in black.

This green tag, printed with form 103, is filled by the stores clerk, and gives the component to which it is attached precedence in factory operations, before everything else except a previously received green-tagged component. Green is the "Emergency" color, and the exhibition of a green tag takes the component



LINK-BELT FORMS.

73

Form 105

PIECE WORK RATE NO. _____

_____ 190

To _____ Dept.

Mr. _____

Please give the following rate for

Rate, _____

Extra Rate, _____

If done in _____

Remarks

Work to be done _____

Amount of Work, _____

Order No. _____ Drawing No. _____

Signed, _____

nated by special "wheel" forms in the factory, and have special cost-finding treatment. Not engraved.

Form 103. Component tag. Yellow. Otherwise, the same as form 103, green. The yellow color signifies "Ship in the rough," and this tag is filled by the storeroom clerk and attached to components sent directly from the storeroom to the shipping room. The yellow color of the tag gives the shipping clerk notice that the component has not been sent by error to the shipping room instead of to the machine shop, and that it is to go to the customer as it entered the factory. Not engraved.

Form 103. Component tag. Manila. Otherwise, the same as form 103, green. Plain manila color signifies normal procedures of all kinds, and shipment by ordinary carriage. Form 103, manila, is made and used as an ordinary component tag. Not engraved.

See also form 15, white linen tag.

Form 104. Erection tools list. Size, $7\frac{1}{4}$ inches long by $8\frac{1}{2}$ inches high. Heavy white paper; printed and ruled in aniline purple copying ink.

Erection tools sent out are charged to the order number in the left hand column, and when returned to the factory are credited in the right hand column.

Form 104 is printed in copying ink, and one copy goes to the tool room and one to the erecting engineer in charge. The original is filed in the engineering department. Tools, when returned, are checked by the tool-room foreman, who reports the shortages, if any, to the engineering department.

Form 105. Piece-rate notification form. Size, $4\frac{1}{2}$ inches long by 7 inches high; medium weight; light yellow; printed in black.

Form 105 is filled by the rate-fixer, after fixing a piece rate on an operation, and by him sent to the department foreman.

The story of the Link-Belt piece-rate fixing does not belong to this account of the cost-finding.

Form 106. Bill of Material, or production order. Size, 15 inches long by $10\frac{1}{2}$ inches high; bankers' linen paper; white; printed in black; ruled in red and blue. Shown in two parts.

Form 106 is a typewritten copy of pencil original made on form 109, and is filled by the engineering department, after the

order drawings are completed. The reproduction is shown as partly filled. The particular inscriptions and symbols would, of course, be varied in each establishment where this form is used. The form is filled with copying ink, and sufficient copies are made from this typewritten bill-of-material sheet, form 106, on a duplicator, to supply two to the machine shop, two to the wrought shop, one to the storekeeper, one to the cost clerk, and one to the shipping clerk; and in case outside erecting is done by the factory, a copy is also furnished to the erection superintendent. Thus all those in charge who are in any way connected with the production have copies of the complete bill of material, mechanically reproduced, and hence certain duplicates.

The "Weight" and "Made By" vertical column is used for two purposes: In the copy which goes to the stores clerk this column is made to record the name of the factory department, to which the rough stores for production of the specified component are sent, so that stores may be readily traced. In the cost-keeper's office copy of form 106, this "Weight" and "Made By" column is used for component weight records. As each department has its own copy, and as the storeroom copy is merely for use of the stores clerk, these different uses of this "Weight" and "Made By" column do not lead to confusion, and both departments have record space without increasing the dimensions of the form.

Form 107. Original purchase order. Size, 6 inches long by 9 inches high; white bond paper; black printing; red, black and blue ruling.

This is a factory purchase order, made by the purchasing department, with carbon duplicates of the original traced on form 107, pale yellow, and form 107, pink. Note the increase in length of the yellow form over the white one, and of the pink form over the yellow, so as to give spaces for records incident to and following the making of an original purchase order. All three forms of each order bear the same consecutive order number, printed in large red letters by the printer who supplies the forms to the factory.

Form 107. Duplicate purchase order. Size, $7\frac{7}{8}$ inches long by 9 inches wide; light-weight paper; pale yellow; printed in black; red and blue ruling.

[illegible]

FORM 106. BILL OF MATERIAL.

Second part, to be joined to first part along vertical line at left.

Form 110		SHIPPING TICKET	
Shipped Via } Acc't of Order No.	Ship to	Issued by	WEIGHT
DISPOSITION	EXPLANATION		

Use this form in ordering and reporting all shipments and deliveries for which regular numbered orders have not been issued. Send *ORIGINAL* to Shipping Department with the goods, and *DUTLICATE* to Bill Clerk with information necessary for billing or otherwise disposing of the charge.

Form 107. Triplicate purchase order. Size, 10 inches long by 9 inches high; light-weight paper; pink; printed in black; ruled in red. This has the same series letter and red consecutive number as the original and the duplicate, and is a carbon copy of the original. It is sent to the cost clerk, who fills the columns and files this pink triplicate form in a binder. When the purchasing agent receives the shipper's invoice he checks the item price and sends the invoice to the cost clerk, who fills the right hand column on his pink triplicate of form 107. The pink form 107 bears the order number, and is filed against that order number by the cost clerk. The height of this form is reduced in the engraving.

Finally, the bill clerk obtains his billing-to-customer prices from the treasurer, on form 89, which see.

Form 109. Original bill of material. Size, $14\frac{7}{8}$ inches long by $11\frac{7}{8}$ inches high; medium weight manila paper; printed in black; red ruling. Not engraved.

Form 109 is the original on which the bill-of-material items are first entered in pencil manuscript by the engineering department, and from this original a typewritten copy is made on form 106, which see. It has the same ruling and headings as form 106, except the headings after "Directions" column, which are lacking. It is on a somewhat larger sheet. Form 109 is filled in pencil to permit ready changes in making.

Form 110. Original Shipping Ticket. Size, $8\frac{3}{8}$ inches long by $5\frac{3}{8}$ inches high. Light-weight paper; yellow; printed all in black.

This form 110, yellow, is filled, with carbon copy on blue form 110, by the official ordering the shipment. The functions of form 110, yellow, are sufficiently defined by the small print instructions at the bottom.

Form 110. Duplicate Shipping Ticket. Blue. Otherwise the same as form 110, yellow, which see. Not engraved.

Form 111. Obsolete Order Cost Sheet.

Size, 17 inches long by $10\frac{1}{2}$ inches high; heavy white paper; ruled in red and blue and having six "bill-of-material mark" spaces, each with five lines for entries and a footing line, the bottom space on the sheet having two footing lines instead of one, to give place for total at the right hand. Only one horizontal

Form 121. Pay envelope. Size, $2\frac{1}{2}$ inches long by $4\frac{1}{4}$ inches high; gummed flap; manila; printed in black.

The blanks are filled by the paymaster, and the money is placed in the envelope by the assistant treasurer, who seals the envelope. The "Benefit Society dues, 12 cents," is crossed out in case the workman is not a society member, this membership being optional, not obligatory.

Form 123. Photographic and blue print department requisition. Size, $10\frac{1}{2}$ inches long by $5\frac{1}{2}$ inches high; white; printed in black, with red ruling.

Special requisition form. Everything that comes out of the blue print and photographing department is charged directly to some specific order. This prevents needless cost.

Form 112				
THE LINK-BELT ENGINEERING COMPANY.				
				Order No. _____
, Outside Pay-Roll for week ending _____				
NAME	HRS.	AMOUNT		SIGNATURE

FORM 112. OUTSIDE PAY ROLL.

Form 124. Drawing room requisition on blue print department. Size, $6\frac{3}{4}$ inches long by $4\frac{1}{2}$ inches high; light blue sheet, printed in black.

Drawing Room requisition for blue prints and for related bill-of-material ("B. M.") press-copy prints from original bill of material, printed and filled in violet aniline ink. See form 106.

Form 130. Daily Wages Cost Sheet. Size, 15 inches long by $10\frac{1}{2}$ inches high; white; printed in black; ruled in red and blue. Perforated for special free binding. Four rows of order-number charge spaces, of which only one row is shown in the engraving, or 24 number spaces in all, on each sheet; 22 day-charge spaces for each order number. The form is shown in two parts.

LINK-BELT ENGINEERING COMPANY.
DODGE COAL STORAGE COMPANY.

REPORT OF ACCIDENT.

(Fill out this report on both sides in the event of accident, however slight, and immediately send it to the office of the Company, Nicetown, Philadelphia.)

IMPORTANT.

In the event of an accident occurring in consequence of the breaking of machinery, belting, flooring, etc., preserve the broken parts.

After an accident has occurred, do not adopt any device for the prevention of a similar accident without first communicating with the company.

Name?.....Age?.....Married or Single?.....
Weekly Wages?.....Address?.....
In whose service?.....
Name and Address of nearest relative?.....
Date of Accident?.....Hour?.....
Place?

General duties?.....
How long employed prior to the accident?.....
Name of appliance, machinery, tool, staging, etc., connected with the accident?.....
Had he been instructed in relation to its use?.....
By whom and when?.....
Was it sound and in good working order at the time of accident?
Was he familiar or not with the work engaged in, or the machinery being operated at the time of accident?.....
Has he worked on similar machinery prior to this employment?
Was he engaged in his regular occupation at the time of the accident?

Was he obeying his instructions when injured?.....
Did the injured employee or any other person ever give notice of any defect in ways, works or machinery connected with the accident; and if so, was such defect remedied?.....
Did the injured party make any statement—and if so, what?—after the accident as to its cause, or admitting his own carelessness; and if so, who heard it?.....

Give name and address of witness?.....

The nature of the accident should be described below, and a rough sketch furnished in order that the cause of the accident may be clearly understood.

The foregoing answers contain a true account of the occurrence by which said person received said injuries.

Dated at.....

On..... Signed

This daily wages cost sheet, form 130, is filled by the cost clerk from the individual component time cards, which each bear

No.	_____
_____	_____
_____	_____
Wages	_____
_____	_____
Car fares	_____
_____	_____
Total	_____
B. S. Dues,	.12
Amt. due	_____

FORM 121. PAY ENVELOPE.

the distinctive "B. M. Mark," or bill-of-material symbol, which reduces chances of error to the lowest probability. One of these sheets is used with each bill-of-material sheet, and is given the

Form 124.

Drafting Room Order for B. P. and B. M.

PHOTO. DEPT.

Date, _____

Please make the following _____

B. P.	B. P.	B. P.	B. M.

Total Square Feet _____

Total _____

Charge _____

Signed, _____

FORM 124. DRAFTING-ROOM REQUISITION.

Form 133

THE LINK-BELT PAY-ROLL

Department	PRODUCTIVE				Undis.	Rep.	M. S. E.	T. S. E.	T. R. E.	P. S. E.	P. O.	M. S. S. T.
	Orders	Gen.	Outside	Total								
○ Mach. Shop												
Wrought "												
Patt. "												
Labor Gang												
Cost Dept.												
Ship. Room												
Store "												
Tool "												
Power House												
Watching												
Stable												
○ Rec'v'g Room												
Totals												

FORM 138. PAY-ROLL DISTRIBUTION.
First part, to be joined to second part along vertical line at right.

order number. It is filled from day to day as the work progresses, and the totals are made when the order is completed, and

Form 138½

L.-B. E. Co.

No. _____

PAYMASTER:

Mr. _____

has { been discharged }
 { been suspended } his time to cease _____
 { left }

Cause _____

Approved:

_____ Supt. _____ Foreman.

FORM 138½. EMPLOYEES' LEAVING RECORD.

these totals are transferred to the bill-of-material cost sheet, which terminates the activity of this form 130.

Form 130 is an evolution from obsolete forms 32 and 111, as

Form 139.

L.-B. E. Co.

No. _____

PAYMASTER:

Mr. _____ has been

employed by me as a _____ rate to be

_____ per hour. Place him on _____ pay roll

commencing _____ 190 _____

Approved:

_____ Supt. _____ Foreman.

FORM 139. EMPLOYEES' ENTERING NOTICE.

Form 153.

PATTERN WANTED

DATE _____

QUANTITY _____

PATTERN _____

DESCRIPTION _____

SHIP ORDER _____

FINISH PATTERN _____

PATTERN FINISHED _____

MARK _____

ORDER _____

LINK-BELT FORMS.

95

Form 152. Drawing-Room Time Card. Size, $3\frac{1}{8}$ inches long by $4\frac{7}{8}$ inches high; yellow; printed in black.

Form 155 Front		SILENT CHAIN WHEEL						Order No.				
NO. WHEELS		DATE FINISHED		LABOR			MATERIAL					
DESCRIPTION		OPERATION			HRS.	WAGES	KIND	WGHT.	PR.	AM'T.		
Diameter		Cut or Forge										
No Teeth		Spilt & Bolt										
Pitch		Bore & Turn										
Chain Width		Cut Teeth										
Pattern ..		Make Flanges										
Flanged		Fit Flanges										
Pattern No.		Turn Flanges										
Bore		Key-seat										
K.S.		Set-Screw										
S.S.		Total										
		%										
		Mfd. Cost										
		Total Cost of Flanging										
		Total Mfd. Cost										

FORM 155. FRONT. SILENT-CHAIN-WHEEL COST CARD.

Form 153. Pattern Wanted. Department pattern production order. Size, $5\frac{1}{4}$ inches long by $7\frac{3}{4}$ inches high; light weight; triplicate; printed in black on three similar size sheets, in three colors—white, pink and yellow.

[illegible]

FORM 155. BACK. SILENT-CHAIN-WHEEL COST CARD.

This inter-department form is filled by the foundry clerk from a production order for the new pattern needed, in carbon triplicate, on white, pink and yellow forms. The white and pink copies are sent by the foundry clerk to the superintendent, who fills the date of order shipment and date of pattern completion on both sheets, and sends the pink sheet to the pattern maker; when the pattern maker finishes the pattern he fills in the "Pattern Finished" space, and returns form 153, pink, to the superintendent; the superintendent then destroys his copy, thus clearing his file, and sends the pink copy to the foundry clerk, who is thus notified of the completion of the pattern.

NAME			ADDRESS Form 167			
NEAREST RELATIVE			ADDRESS			
DATE EMPLOYED	AGE	FORMER EMPLOYER		PREVIOUS OCCUPATION		
OCCUPATION	RATE	CHANGE IN RATE				
DATE LEFT	CAUSE	NAME OF FOREMAN				
NOTES RELATIVE TO CONDUCT, HABITS AND PROMOTIONS						

FORM 167. EMPLOYEES' RECORD CARD.

This form permits the foundry clerk to expedite order production by ordering pattern production himself, without the intervention of the engineering department as creators of the pattern production order.

Form 155. Front. Size, 5 inches long by 3 inches high. Printed in black, with red ruling. This stiff-card form is printed front and back both. See form 155, back.

Form 155 is filled by the cost-keeper and kept in a cabinet in the cost-keeper's room. This card records material and flat-labor costs of "silent chain wheels" in detail, and totals of "man-

Both sides of form "A" are ruled and printed the same. This form is filled in the paymaster's department. Spaces to the left of "piece work" column are for special distribution items, blank head spaces, and regular distribution items with printed headings. This form is engraved in two parts. Only one horizontal section is shown in the engraving. There are six more similar sections underneath.

The totals should be equal, thus giving a check on the correctness of the distribution items. There is one copy only of this form.

The separate-leaf form of volume permits two or more clerks to be employed on one week's pay roll at the same time.

Form "B." Pattern Order Costs. Size, $9\frac{3}{4}$ inches wide by 14 inches high; medium weight; white book page. Red and blue ruling, same on both sides. There are 43 horizontal lines, of which only 7 are shown in the engraving.

Book page form of the pattern cost book, filled and kept in the cost department.

CHAPTER V.

THE COST-FINDING SYSTEM OF THE BIGELOW COMPANY, OF NEW HAVEN, CONN.

The cost-keeping methods of the Bigelow Company, manufacturers of boilers at New Haven, are taken as illustrative of a successful system for an establishment working about two hundred men, partly on inside work and partly outside. The system itself is the outcome of systematic and deliberate study—a construction rather than a growth.

The company is organized under a president, a general manager, who is present most of the time at the works, and a vice-president and sales manager in the New York office.

The works are divided into two general departments, the one known as the machine, pattern, and blacksmith shop, and the other as the boiler and sheet-iron shop; these are in charge of separate foremen. There are two separate tool rooms, one for the machine shop and one for the boiler shop, which are in charge of separate tool-room foremen.

The rough stores consist mainly of castings, rivets, plates, and stamped or formed plate details, as man-hole covers, pressed steel being now used in places where castings were formerly employed. The castings, which are mostly large, are all purchased outside, and are stored in the open yard adjacent to the departments where they are to be worked. The rivets go to the store-room opposite the office, and are in charge of a youth, who delivers them on verbal orders from the riveting-gang bosses. He turns his memoranda over to the stock clerk, who is in charge of the rivet room and sheet stores, and delivers sheets to the layer-out, under directions from the boiler-shop superintendent. The superintendent's requisitions are based on the separate order specifications received from customers, which are transmitted directly to the works and form the production orders. These orders are so varied that no production-order blank is used.

Each order thus takes the form of a type-written specification, in general form similar to the one below.

- Every needful statement of requirement and condition, date of order and delivery date included, is, as will be observed, noted on this production order, so that the work can be intelligently brought out in the shops. Some of these individual-specification production orders are much longer than the one given; others are much shorter, calling perhaps for a number of rivets of a

COPIED. N.Y. ORD. 3251. THEIR ORD. 37096.	SEPT. 20, 1902.	FACTORY NO. 615	RECEIVED SEP 20 1902 BOILER SHOP
<p>FOUR 6" SEPARATORS COMPLETE AS PER THEIR DRAWING NO. N.Y. - 6020; TO BE 30 1/2" INSIDE DIAMETER AND 3 FT. 9" FROM CALKING EDGE TO CALK- ING EDGE; HEADS TO BE DISHED; ONE HEAD TO BE REVERSED; SHELL 7/16"; HEADS 1/2".</p> <p>THE ABOVE MUST BE SHIPPED SO IT WILL ARRIVE AT DESTINATION BY JANUARY 1st, 1903,</p> <p>SHIP TO ---</p> <p>BLUE PRINT HAS BEEN SENT US SO WE CAN ORDER STOCK.</p> <p>AS SOON AS WE HAVE TAKEN THE NECESSARY MEMORANDUM FROM THIS FOR ORDERING THE STOCK WE ARE TO RETURN THE BLUE PRINT TO OUR N. Y. OFFICE AND IN A FEW DAYS THEY WILL SEND US OFFICIAL WORKING BLUE PRINT.</p>			

THE TYPE-WRITTEN PRODUCTION ORDER.

certain kind, or a piece of boiler plate punched and bent to certain specifications. All of these production orders are simply type-written sheets or slips, made at either the New York or New Haven offices of the works according to place of receiving them, and go directly to the department superintendents, without formalities or loss of time. If received in New York, the order bears a New York office order number, and each order is given a factory number, against which all production charges are entered. All orders are first copied in numerical sequence in the general factory-order copying-press book, kept in the main factory office, and two duplicate order copies are made, one being delivered to the cost clerk, who has an office with the boiler-shop superintendent on the ground floor adjoining the main boiler shop. He

pastes all his copies in a large book marked "Boiler-Shop Orders." The second duplicate goes to the superintendent of the machine shop, who has a similar book, lettered "Machine-Shop Orders," in which he pastes his full copy of each production order complete. The machine-shop superintendent and the boiler-shop superintendent and the cost-keeper thus each have all particulars of each order, and each proceeds independently to bring out his individual portion of the structure demanded; in most cases the machine-shop work must and does, of course, precede the boiler-shop work.

All requisitions made by the machine-shop and boiler-shop superintendents on the rough-stores clerk have the order number, and the stores are delivered by the stores clerk and by him charged on his "Stores Delivered" book against the order number.

If a rough-stores order cannot be filled from stores in stock, the rough-stores clerk makes a proper order which goes through the main office to the outside source of supply. The rough-stores clerk examines the boiler-shop and machine-shop order books twice daily, morning and afternoon, and scrutinizes each order with care, and makes his requisitions on outside sources at once, so that the least possible delay intervenes between the receipt of a production order and the placing of needed material in the rough-stores room.

The tool-room charges are made against individual workmen on form 1, reproduced in full. These forms are kept in alphabetically designated pigeon holes in racks in the two tool rooms, the same form serving for both. Charges are made by the tool-room keepers against the workman whose name heads the form, when tools are taken out, and cancelled by crossing off the charge when tools are returned in good order. Tools returned in bad condition are made the subject of inquiry if occasion demands, and may be charged to the workman if he is grossly in fault.

Flat-cost charges are made against production-order numbers on the boiler-shop and machine-shop detail-charges sheet, form 2, enough sheets being numbered with each order number to contain all the charges against it. Form 2 is printed on both sides, and the back is in two forms, one for boilers, and one for machine and miscellaneous orders. These forms are filled by the cost

Name, _____		Date, _____	
No. of Pcs.			
DRILLS AND SOCKETS.			
Drill Sockets,	Size, _____	Kind, _____	
" Chucks,	" _____	" _____	
Twist Drills,	Size, _____	Taper, _____	Straight, _____
Ratchet "	" _____	" _____	Square _____
Flat "	" _____	" _____	" _____
Counterbores	" _____	" _____	" _____
TAPS.			
Hand Taps,	Size, _____	Taper, _____	Straight, _____
Stay Bolt Taps,	" _____	Bottoming, _____	
Pipe Taps,	" _____	_____	
Special Taps,	" _____	_____	
PUNCHES AND DIES.			
Screw Punches,	Size, _____	Dies, _____	Punches _____
Tube "	" _____	" _____	" _____
Rivet "	" _____	" _____	" _____
TUBE EXPANDERS AND TOOLS.			
Expanders,	Size, _____	Pins, _____	Rolls, _____
Tube Cutters,	" _____	_____	
" Reamers,	" _____	Cutters, _____	
REAMERS.			
Pipe Reamers,	Size, _____	_____	
Rivet "	" _____	_____	
WRENCHES.			
Monkey Wrenches,	Size, _____	_____	
Open "	" _____	_____	
Ratchet "	" _____	_____	
Adjustable "	" _____	_____	
Tap "	" _____	_____	
Hack Saw	Blades, _____	_____	
HAND TOOLS.			
Snap Rivet Cupping Tools,	Size, _____	_____	
Handle	" _____	_____	
Hand Markers,	" _____	_____	
Chisels, Cape	_____	Diamond Point, _____	Flat, _____
Chipping Hammers,	_____	_____	
Riveting	" _____	_____	
Drift Pins,	_____	_____	
PNEUMATIC TOOLS.			
Engines,	Piston, _____	Rotary, _____	
Hose,	Length, _____	_____	
Hammer,	Calking Tools, _____	_____	
"	Beading Tools, _____	_____	
"	Stay Bolt Cups, _____	_____	
Hydraulic Jacks,	Size, _____	_____	
Chain Falls,	" _____	_____	

FORM I. TOOL-ROOM CHARGE SHEET.

The original is more open, being 5 by 14 inches, heavy manila paper.

Plates in shell				
Straps				
Dome plates				
Dome heads				
Heads				
Barrel plates				
Fire box plates, inside				
Fire box plates, outside				
Top head				
Fire box head				
Reverse flange				
Rivets				
Stay bolts, solid				
Stay bolts, hollow				
Feet of _____ tubing				
Feet of _____ tubing, extra heavy				
Brackets, cast iron				
Nozzles " "				
Flanges " "				
Fronts " "				
Castings for setting				
Braces, bar iron				
Anchor bolts " "				
Hangers " "				
Front " "				
Front, angle iron				
Trimming				
Stiffeners				
Fusible plug				
Manhole plates				
Handhole "				
Sheet iron				
Angle "				
Feed pipe				
Bolts				
Fire brick				
Insurance				
Hours Boiler Shop				
" Machine Shop				
" Forging				
" Pattern Shop				
" Draughting				
Lumber etc. for loading				
Cartage				
Freight				

FORM 2. BACK OF WORKMEN'S TIME SHEET.

This is known as the "Regular" back, as it contains spaces for all regular charges against horizontal or Manning vertical boilers. The "Special" form has no printed list, but is filled by entering the order. Weights or numbers are entered in the first vertical column, flat cost values in the second. Particular conditions or charges are noted in the horizontal lines at the top. The form is 5½ by 9½ inches.

clerk from the rough-stores book for the entries on the back, and finally, after both back and front sides are filled, they go to the bookkeeper, who enters the totals on the margins of the office order-book sheets where the original production orders are pasted. These blanks are then stamped "Charged" in large capitals, green ink, and are finally filed away as originals for future reference.

Saturday MAY 10 1902	
Hansen ⑤ 1- car 286 4-493	Bartman ⑥
St. Hris ⑪ 4- Iron 286 6- cut 1- set	McKay 3- spark 6- BS
Barnes 9-258	Schutts 1- key 2- 286 2- 288 4- Pinner rolls
Clark 9- 285	Watson 9- BS
Bigelow 9- 286	Weith 9- 286
Chapman 9- Col.	Dwyer 9-210
Conley ⑩ 2- Cut 1- Team 7- gate	Green ⑩ 625
PHansen 9- BS	Thutts 1- 288 2- 286 2- 78 5- Pat
Sandquist 1- 288 8-210	Way 9-258

MACHINE-SHOP DAILY-TIME CARD.

A partial exhibit. The date is stamped in green ink, and the manuscript written daily by the cost clerk. Short-time and over-time entries are enclosed in circles. The boiler-shop time sheet is kept in the same way.

The workmen's time cards are in manuscript, written by the cost clerk, and by him filled from information gained by questioning individual workmen in the machine shop, from each individual smith's book kept by himself in the blacksmith shop, from the pattern-shop time book, which is made up by the cost-keeper by individual questioning, and from the boiler-shop gang bosses,

RULES AND DIRECTIONS

FOR

Charging and Filling Out Time Tables.

All men employed by us, when at work at any place outside of our works, are required to have their time written down on this table (on opposite side) and signed by the engineer or person in charge.

Nine hours—from 7 A. M. until 5 P. M., allowing one hour for dinner—constitutes a day's work, and will be charged as ten hours. No men sent out for less than two and one-half hours.

Time occupied in traveling both ways, between our works and the place where the work is performed, will be charged as single time.

When filling out the table for work done at Night, Sundays, or Legal Holidays, please state the number of hours worked, as two hours are allowed for each hour's work performed at such time.

Any expense incurred, such as traveling expenses, meals and board of men, will be charged to the parties for whom the work is done.

We pay our men and make our charges according to above rules.

THE BIGELOW CO.

BACK OF FORM 3—OUTSIDE-WORK CARD—BOTH THE GRAY CARD LEFT WITH CUSTOMER AND THE TERRA COTTA CARD VOUCHERED BY CUSTOMER AND RETURNED TO THE BOOKKEEPER.

who keep slates or chalk-mark records of one day. Every piece of stock takes the job number in white paint when delivered from the rough-stores room,

The smith-shop workmen's time is taken in the same way, the boiler-shop workmen's names lists and the smiths' names lists being written together daily, on large sheets, of sufficient size to contain all.

Outside work is recorded on two similar blanks, Form 3, $4\frac{3}{8}$ inches by $6\frac{1}{2}$ inches, grey and terra-cotta color, stiff cards. Both these cards are filled by the outside worker day by day, as he works, with both time and material charges, and both are signed by the foreman or customer where the outside work is done. When the job is finished the grey card and the terra-cotta card are thus duplicates, vouched by the outside authority signature. The terra-cotta card goes to the cost clerk and the bookkeeper, and the bookkeeper makes a bill therefrom to the customer. The grey card is left by the workman, on completion of the job, with the customer. As this card bears the customer's own voucher it cannot be disputed.

When the customer receives the bill he has only to compare the total charge of time and material with the duplicate in his possession. These outside-work blanks are printed on both sides. The back is printed with the workman's instructions, and the front is printed and filled as shown in the two reproductions given showing the customer's duplicate and the factory time card.

The items of "unproductive labor," which include every sort of work done other than office and clerical work, not directly charged to any production order, are taken by the cost clerk daily, in his round through the shops, made when he fills his daily manuscript time sheet. The separate items are recorded in detail on a monthly-statement sheet of unproductive labor, which is turned in to the bookkeeper and by him is charged to expenses, divided into various charges against shop betterment, patterns, shop cleaning, and so on.

The shipping clerk besides attending to shipment details does some estimating; he looks out for the railway transportation, and is responsible for shipping details generally. Work ready for shipment is notified to him by department foremen on a "Ready

for Shipment" card, white, 3 by 4 inches, stating that "Order No. _____ is now ready for shipment," and signed by the foreman.

The clerical force comprises a chief bookkeeper, shipping clerk, rough-stores keeper, with an assistant youth in charge of rivets, the cost-keeper, and his assistant, also the stock-clerk. The number of men in work varies from 175 to 200, as orders may demand.

Almost the entire work of collecting and recording prime-cost items is performed by the cost-keeper; his assistant, the stock-clerk, has the receipt and delivery of stores in charge. The

Ready for Shipment.

_____ 190

Order No. _____ for _____

is now ready for shipment

Foreman.

cost-keeper is also the time taker, and rules and fills the manuscript time cards every day, and also handles the brass check board and workmen's brass individual checks, by which the entering and leaving times of the workmen are recorded, and does this work so easily as to have spared five hours in one day for giving the information here presented to the writer, without apparent inconvenience.

Each rivet order is filled in small excess of number, and from time to time the left-over rivets are collected in bulk and delivered to the youth in charge of the rivet bins, who sorts them into their individual places. The rivet shed stores the flanged work, one

side being occupied by rivet bins and kegs, and the other side by flanged work and pressed-steel man-hole plates.

In addition to the forms shown, there are two books of copied entries made up from the cost-keeper's time sheets, one named "Machine-Shop Day Book," and the other "Boiler-Shop

RACK	NO. OF PLATES	LENGTH	WIDTH	THICKNESS	FACTORY
					ORDER NO.

FORM 4. SHEET SHOWING DELIVERY TO WORKS ON PRODUCTION ORDERS.

The original is a stiff white card, 5 inches wide by 7 inches high, having 16 entry lines under the heading as shown. The plates are stored in racks, and the first column shows sheet-rack numbers.

Day Book." These books are both written by the cost-keeper daily, and these two day books are written by the bookkeeper into finished-product bills, made to purchasers. These day-book items are variously stamped in green ink by the cost-keeper, "Outside Work, No Material," "Outside Work, Material Charged," as may be, in one right-hand column, and the last entry on a given order is followed with a "Completed" stamp in green ink.

While this costing system shows a firm resistance to the multiplication of form blanks, and some comparatively unimportant items are not rigorously collected, it is nevertheless true that close approximations to accurate costs are made by its use, and it is also true that these fairly correct costs are obtained by a very small outlay of clerical labor, and the long-continued prosperity of the company amply proves the practical sufficiency of this simple set of cost-keeping forms.

The fact that the boiler-shop gangs are made up of constantly changing permutations of the same workmen, gives rise to the manuscript time sheets in the form of original productions by the hand of the cost-clerk for each day's record.

CHAPTER VI.

THE C. B. COTTRELL & SONS COMPANY, WESTERLY, RHODE ISLAND.

This company manufactures printing presses of many different kinds, devoting its attention more particularly to those which do fine magazine, book and color work, and to presses which not only print both sides of the sheets at one operation, but also fold the sheets to publication size, without waiting for them to dry. More than 100 different sizes and forms of presses are produced, varying in price from \$1,000 to as much as \$35,000 each, according to their powers, uses and intricacies of construction.

This company is now officered and conducted by three sons of the original founder of the business, Calvert B. Cottrell, born in 1821, at Westerly, R. I., the location of the present factory.

Calvert B. Cottrell was of a highly inventive turn of mind, and had 125 United States patents issued to him, as well as many foreign ones. These numerous patents covered many minor inventions in printing presses, and several radical improvements of great importance in the operation of flat-bed presses, the speed of which was materially increased. Later, the "shifting tympan," by which the Cottrell "rotary perfecting" presses were made, the first of all presses to satisfactorily print both sides of fine "illustrated" sheets from a roll of paper without "offsetting," was brought out, and to this other improvements were added, so that finally the sheets were cut with smooth edges and folded into any desired form, all at one operation, without waiting for the ink to dry. These improvements gave the Cottrell printing presses an advanced position which has never been lost.

Very shortly before the death of the elder Cottrell, in 1893, the business was incorporated by his three sons, Edgar H., Charles P. and Calvert B. Cottrell, Junior, and himself, as the

C. B. Cottrell & Sons Company, the fourth and youngest son, Arthur M., becoming a partner in 1900, soon after the untimely death of Calvert B. Cottrell, Junior. All of the sons were bred to the trade, and are practical machinists, and inherit their father's rather unusual combination of inventive genius and business ability.

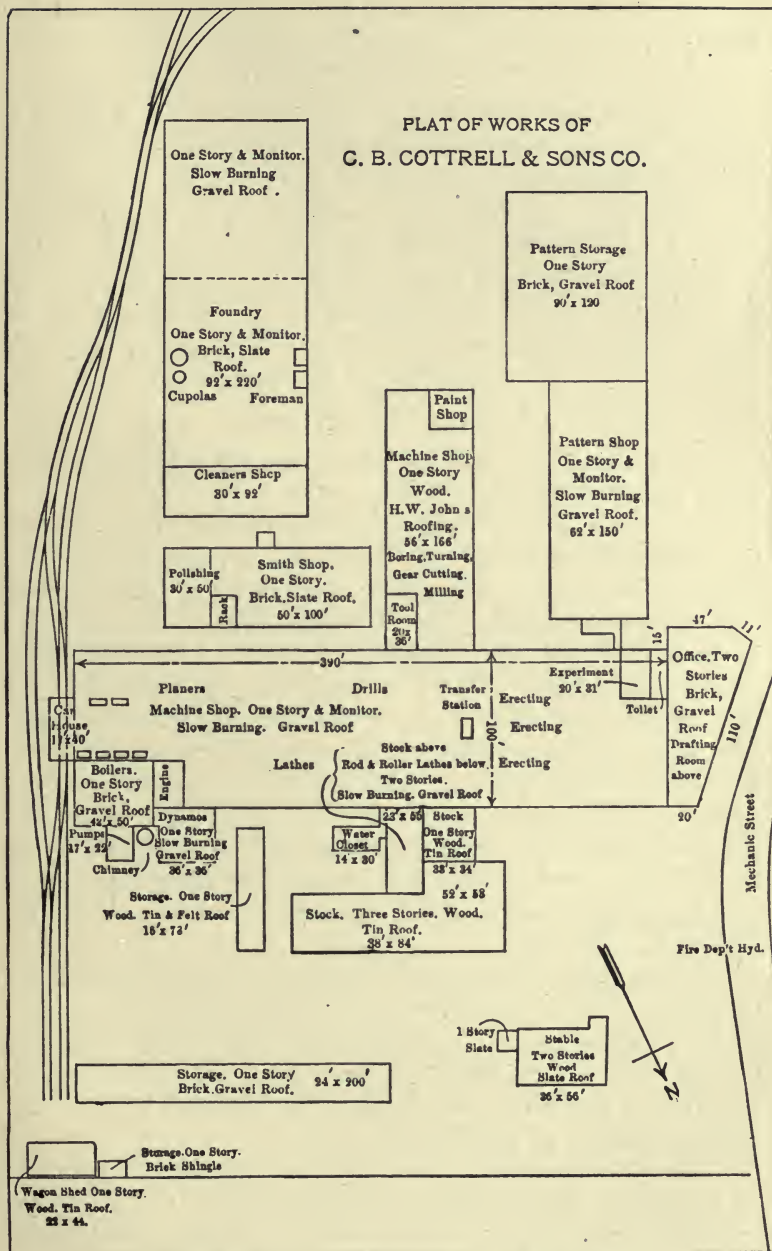
The Cottrell factory is one of the most perfectly organized of American machine shops. This establishment makes its own castings and forgings, and employs a large outside force of both salesmen and workmen, besides 450 inside workmen, and consequently uses a very full list of blanks, which have been worked out, simplified, reduced in size, and brought into the most labor-saving form at a very large expenditure of time and thought, and are, if not the very best, certainly among the best of their respective sorts, and are, therefore, entirely reproduced here, although many of them are not used in cost-finding. A vast amount of toil and uncertainty can be avoided by the use of well-devised blank forms, which ensure the record of all required items, and reduce the manuscript requirements to the lowest terms. These Cottrell forms are excellent examples of the most modern aids to the conduct of a good-sized manufacturing business, and will undoubtedly be closely scrutinized by all readers interested in the sales of factory product.

The whole business, commercial and mechanical, is subdivided into units of very limited area, so that expense items can be traced to their origin with certainty. The reduction of the size of the field under observation is an absolute necessity, if accurately detailed costs are desired.

THE FACTORY OFFICES.

As will be seen by the plan of the Cottrell works, the factory offices are at the west end of the principal machine-shop structure. The office building is of brick and stone, with very large vaults on the first floor and above as well, the upper floor of the office building being used for the drawing room.

Everything connected with the office building is of the finest description, all the furniture is of quartered oak, and the cabinets and card trays are of the latest type, all heavy drawers running on ball bearings, and the revolving cabinet in the general office



PLAT OF THE C. B. COTTRELL & SONS CO.'S WORKS.

A few of the minor outlying buildings are not shown.

being also on ball bearings and moving with a touch of the finger.

CHART OF AUTHORITY.

This is a reproduction of a small blue print sheet issued to officials, defining rank and precedence and showing the factory and shop subdivisions.

The duties of officials are carefully apportioned, so that those of lower grades are confined almost exclusively to routine performances, occupying nearly the entire working hours of the day, while the higher functionaries have very small fixed demands on their time, and so are left free to give attention to whatever may be most important at the moment.

LOCATION OF OFFICIALS.

The head of the sales department manages the New York office, and the sales offices in other cities.

The general office staff (see Chart of Authority) occupies the different rooms of the office building (see plan of the works). The production-order clerk's desk is in an office room, between that occupied by the head of the "Department of Product," who is the general business manager of the factory, the head of the "Department of Plant," who is the factory superintendent, and the general office manager, and the main machine-shop floor. The three principal officials named occupy the principal room in the office building together, having separate desks. The same room is used for the reception of visitors and business callers, and is furnished with the three desks specified, and also has a fourth desk used by the manager of the New York office when at the factory, a large library table covered with current publications, a telephone and chairs.

A very elegant corridor runs between the machine-shop and the offices. The office room next the corridor entrance is occupied by the purchase agent. Next comes the paymaster's room, then the cost clerk's room, then the general accountant's and cashier's department, and finally the large room occupied by the three principal officers, as specified.

The production-order clerk does not appear on the Chart of Authority. This position is, in a shop sense, that of private secretary to the head of the department of product, and his duty

DIRECTORS

EXECUTIVE COMMITTEE

SALES DEPT.	GENERAL OFFICE	DEPT OF PLANT	DEPARTMENT OF PRODUCT	
Advertising	Dep't. 3 Correspondence	Dep't. 10 Shipping	Dep't. 14 Draftsmen	Dep't. 15 Patterns - Wood Working
Erection	Dep't. 4 Filing-Mailing	Dep't. 11 Stores	Dep't. 19 Foundry	Dep't. 20 Forge Shop
New York Branch	Dep't. 5 Accounting-Commercial	Dep't. 12 Tracing	Dep't. 21 Shop Sections	
Chicago Branch	Dep't. 6 Accounting-Cash	Dep't. 13 Teaming	Sect. 1 Tool Makers	Sect. 9 Erecting 2 Rev.
Philadelphia Branch	Dep't. 7 Accounting-Factory	Dep't. 16 Power, Heat, Light & Protective	Sect. 2 Gear Cutters & Milling	Sect. 10 Erecting General
Boston Branch	Dep't. 8 Orders	Dep't. 17 Construction & Repairs	Sect. 3 Planers	Sect. 11 Rod Lathes
	Dep't. 9 Purchasing	Dep't. 18 General Labor	Sect. 4 Drills	Sect. 13 Erecting Rotaries
		Dep't. 22 Receiving	Sect. 5 Setting up Frames	Sect. 14 Stock Building
			Sect. 6	Sect. 15 Buffing
			Sect. 7 Cylinder Lathe	Sect. 16 Box Shop
			Sect. 8 Lathes	Sect. 18 Paint Shop

CHART OF AUTHORITY.

is simply to detail the orders of the head, and translate them into shop terms.

The purchase agent makes the purchases, receives commercial travelers, and makes the repairs production orders as a rule. (See form 19.)

The paymaster receives all time cards, makes up the payroll and admits tardy workmen to the factory.

The cost clerk and his subordinate, the cost-analysis clerk, and two assistants handle the production records.

The chief accountant and two assistants and the cashier take care of the commercial business and the cash, the cashier having charge of the correspondence files.

The very fine cabinet located adjacent to the desks of the general office manager and the factory superintendent is mounted on a stand, and fitted to revolve on ball bearings. The size of this cabinet is $21\frac{3}{8}$ inches high, $27\frac{1}{2}$ inches long, and $18\frac{7}{8}$ inches deep. It has ten drawers, inscribed on the left-hand row reading from the top down: "Press Orders Shipped," "Employee's Complaint Cards," "Purchase Orders Unfilled"; on the middle row, "Press Orders in Progress," "Collection Cards Settled," "Purchase Orders Filled"; and on the right-hand row, "Specification Book and Wabash File Index," "Shipping Memoranda," "Cost Cards" and "Claims Slips."

This cabinet and a periodical-filing cabinet in the main office room are aids of the greatest value in office work.

MECHANICAL AIDS.

Typewriters are used in the offices, and there are three "Comptometers" in use in the counting room. The factory accounting is very largely on cards, and detachable binding is the rule for account volumes.

A stencil machine, which is to the marking brush what the typewriter is to the pen, cuts stencils, generally in paper, for marking every shipment. By use of this machine, a boy can cut stencils of thick paper for a few cents each, thus ensuring correct, legible and uniform marking of all shipments to the same address.

Electric light is used exclusively for blue-printing.

Communication throughout the factory is by the "in" and

"out" basket and constantly journeying messenger system. Every official's desk is furnished with an "in" basket and an "out" basket, and messages are very promptly delivered without any messenger call whatever. The departments are also all connected by telephone, and "buzzer" calls are on every foreman's desk.

The shop's time system makes all the clock-dials in the factory show exactly the same time, a matter of considerable importance.

SHOPS, WORKMEN AND LABOR CONDITIONS.

There is a framed and glazed card of "Rules," inconspicuously hung near the office of the machine-shop superintendent, which specifies working hours, 6:30 A. M. to 12, noon, and 1 P. M. to 6 P. M. for five days in the week, and from 6:30 A. M. to 12, noon, on the last work day of the week.

The factory runs double shift much of the time.

The rules also specify that there is to be no smoking in the factory or on the premises, no reading during working hours, and that tools and machines shall be properly cleaned and cared for, and altogether they are very far from laying down vigorous limitations of conduct.

The workmen are almost wholly Americans, principally of English ancestry, and there are many instances of two generations of the same family employed as workmen.

The town is without trolleys, and the bicycle is very largely used by all classes. The company makes no systematic provision for housing its workmen.

The factory heating and ventilation is by a blower system, sanitation is excellent, and the drinking water is all supplied from the "Cottrell Spring," a large natural spring on the "Cottrell Farm," little more than half a mile from the factory. A spur of the N. Y., N. H. & H. Railway enters the factory at one end, and the Pawcatuck River bounds the factory site on the south, giving abundance of water for factory uses. The environment is rural and puritanic; the town is "no license" and harbors no irregularities of any sort.

The factory has no benevolent association, no library and no distinctive social features.



The shop pace is fast, and the greatest possible use is made of machinery, the policy being to use a very large machine plant with the smallest possible manual attendance, and some very surprisingly small labor costs are obtained, especially in the particular of printing-press cylinder finishing. The press cylinders are bored, mounted on their shafts, turned and ground to very small error limits at incredibly low prices.

The workmen's entering time is recorded on a unique machine operated by a youth, this time recorder, invented and patented by the Cottrells, indenting the time sheet for each man's number as he passes the time-record window. As the workman passes he simply calls his number, and the recorder operator moves the lever which indents the time-record sheet opposite the number called, as fast as the men, who touch nothing whatever, can pass the window. When the whistle sounds for starting the time taker turns the men yet outside, so that they must pass the paymaster's window, where the least time loss is half an hour.

The youth who operates this time recorder is expert, and can pass the 450 hands into the works inside of ten minutes. The whistle is blown ten minutes before, and at starting time.

Time records are made on entering only. If a hand wants to leave before 12 or 6 o'clock he must turn in his time card to his foreman and obtain consent to his departure. Full time, 58 hours a week, is the rule, and the pay is by hour and piece rates, no "premium" rate being given, and the percentage of piece-rate payments is small, being confined principally to planer work and the cylinder finishing before mentioned. Although none of the later methods of stimulating the workmen to increased production is used, the pace of the factory is, as before stated, fast, and voluntary diligence is the rule.

COMPONENT TRACING.

The distinguishing feature of the Cottrell factory practice is the method by which components are traced, their shop travels dated and recorded, and their location and stage of completion made always ascertainable at any moment.

When the experienced visitor first views the Cottrell erecting floors and sees, maybe, 40 presses in process of erection, no two

lots exactly alike, some comparatively simple, and some of the most complex character imaginable, he is at once impressed with the extreme difficulty of keeping track of the many thousands of parts which must evidently be constantly under construction, and his curiosity is accentuated when he discovers that no less than 900 different castings production orders are sometimes written for a single press, and that the entire structure may require as many as 3,500 differing components for its completion, counting forgings as well as castings. A great multitude of these differing components are comparatively small, and are, of course, made in large lots and kept in stock in the storeroom, ready for use as required. But making full allowance for the aid given by the storeroom, it is clear that there must always be a vast number of unlike pieces in progress in the factory, probably, in fact, never less than 10,000 or 15,000 different pieces.

It is absolutely necessary, for factory purposes, that three things should always be known of each individual factory production, great or small, simple or compound. First, under what production order the component is produced; second, where the component is located at any instant; third, what the state of progress is. All this must be known concerning subproductions. In regard to principal productions, it is needful to know what components of each are completed, and in what stage of progress the incomplete components are, at any instant of inquiry.

Not only must these things be ascertainable in regard to the single component or the principal order, but they must be knowable without loss of time.

How shall this information be so recorded as to be instantly available? If any form of written records is considered, it at once becomes evident that something beyond ordinary indexing must be used to locate the record. With thousands of components in progress in the factory, many of them will change their locations from one department to another at the same time; hence great celerity in record finding, and in record making on the record sheet when found, must be possible. One man must do what work in writing the records is needed, because confusion would surely follow if two men endeavored to do the work. Clearly, this matter of accurately following so

great a number of pieces in the factory demands extreme measures. The component histories must be written, since no memory could by any possibility retain the record.

First, then, what is the simplest and shortest dated record of a performance?

If the day is a small enough time unit, then four date symbols, as "17/11" for "November 17th," is brief, and can be written quickly; but how about writing the story of the occurrence, which alone gives the date record value?

The thing on which the date record is made must be moved to write the inscription on it, and must be replaced for safe keeping. Here, then, are three actions to be performed, taking the record out of something to write the date on it, writing that date, and putting the record back in some safe receptacle for future reference.

Charles P. Cottrell's conception of the solution of this "tracing" problem was to place a small, stiff card, bearing the component symbol and order number, in a grooved tray, standing upright, when a component accompanied by its production order entered a factory department, and, say that the card was the component, and the grooved tray was the department. The nature of the operation is always determined by the factory department. The stiff cards, each in its own groove, standing upright alone, can be selected at a glance. When the first department operation is completed and the component must go to another department, the card is taken out of the tray representing that department, the date written on the back of the card with the department number, and the card put in another tray representing the department to which the component is to be next taken. Here, then, is the whole story, the entire history, recorded by two movements of the card, and by writing either 3 or 5 characters on the back of the card, in addition to writing the department number.

For example, this dated record, "November 17, 1902, component 10 K-No. 109, had been completed as to planing, and was placed in the drilling department," can be made by simply taking a card out of a tray in which the card stands upright, with its symbol-inscribed face fully exposed, so that it may be selected by mere visual observation of the cards in the tray,

and writing, at the most, five characters, "17/11," on the card and then transferring the newly dated card to another tray, representing the shop section which the component is next to enter. This is certainly a very quick and sure method of producing this record.

The whole internal economy and practice of the Cottrell factory is based on the use of small, stiff cards, set in trays, as specified.

GLOSSARY OF TERMS USED IN THE COTTRELL WORKS.

BASKET.—"In" and "out" communication receptacles, usually placed on the tops of the desks of factory officials to hold factory communications. These communications are distributed to their receivers by a constantly traveling messenger, who asks no questions and makes no remarks, but simply clears the "out" baskets and fills the "in" baskets with what he may have for them.

CABINET.—Case or chest of sliding drawers, used to hold cards inscribed with factory accounting records, or cards bearing any inscriptions of any sort, or books of quarter-sheet size blue prints.

COMPONENT.—Any single piece or part of any machine. In this book "component" is applied to parts of machines only. Components are "simple," if they are integral, of one piece only, and "compound" if composed of two or more pieces, named and treated as one piece after the parts are assembled.

COSTING.—Cost-finding, or cost-keeping. This word is used by English and Scotch factory accountants, and is short and graphic, and will be used in this book.

DESTROYED.—Some traveling forms having functions relating to the factory only, are "destroyed" as soon as their work is done. "Filed" and "destroyed" are the two words used to indicate the end of the active life of the form.

FILED.—Finally disposed of and done with, except as to casual future reference. The factory intends to preserve complete records of every performance, fully dated, so long as such record may be useful. In many cases the record must be permanently kept. In many other cases the record need be kept for only six months or a year.

FILL, FILLING, FILLED.—All forms have spaces to be

filled in manuscript or typewriting. So far as possible, the use of the pen is avoided, typewriting being less liable to mislead the reader. To "fill" a form is to write on it what is needed to put it in work. Some forms are vivified by the mere act of filling; other forms have to be vivified by an official superior to the writer, who fills the form. In general, to "fill" a form is to begin its action. To "file" a form is to end its action. The words "fill" and "file" are short and graphic; they resemble each other more closely than is desirable, but because of brevity they are adopted for use in this book.

FORM.—Any printed blank, having spaces to be filled in manuscript. The "form" is the all-important feature and agent of modern factory costing and accounting, and form-space titles are of the highest importance in labor saving; and in general, a "form" is a special tool, designed with the greatest care to perform certain functions in the best possible manner, and the forms shown are all the results of many costly experiments, and are of very great value for comparison, and also as good examples of approximations to ideal construction.

FORM-BACK.—In many cases the back of a form is printed with blank-space headings and titles, designated in this book by the inclusive term form-back.

HEAD.—The autocrat or chief ruler of the factory. Used as a short title, to avoid two or three words every time the chief executive is mentioned.

IN WORK.—A form or document is "in work" when it has been vivified. A piece of machinery is "in work" when the rough casting or forging or rough stores for producing the piece go to the working floors of the factory.

LISTS.—Printed or written lists of components of complete, assembled machines. The lists contain the names and symbols of all the different pieces contained in one machine when it is complete, ready for shipment.

LODGE^{MENT}.—The temporary and non-final resting place of a journeying form or factory document. The lodgement of forms is an important functional condition, and the word is necessary.

OFFICE.—The factory office, as distinguished from the various offices of the factory interior. The factory interior offices

house the factory department heads, beginning with the machine shop superintendent.

OFFICIAL.—Any one having authority to give working orders to another.

PUNCHED.—Officially marked as vised and approved by cutting with official punch. The punch is used in the Cottrell factory by the machine shop superintendent only.

TRAY.—Any receptacle for holding cards or forms. The whole economy and practice of the Cottrell factory is based upon the use of cards and trays. The "trays" may either be card-cabinet drawers, or special boxes without covers, made to fit the particular "forms" placed in them. See "Waiting Tray."

WISE.—To officially look over, examine, approve and pass. Many of the Cottrell forms are migratory, and perform important functions by merely passing through the hands and under the eyes of officials who do not fill or file them, but either mark them as approved, or perhaps retain them for a time, and then pass them on to another official. The word "vise" is used in this connection. There is no fully supporting authority for this use of "vise," pronounced "vize," but we have "revise" the French "vise," pronounced "vezay." Vised, with the English pronunciation in the sense given, is a short and useful word, and will be employed in this book.

VIVIFY.—To vitalize and make mandatory and effective. All factory orders are supposed to be written. Oral orders are used only in cases of emergency and disaster, and have no part in the intended course of factory procedures. All forms are "vivified" or authorized by the signature, initials, mark or punch of some official, whose sign manual puts the form in work, and shows who is responsible for the issue of the form.

VOUCHER.—Any convincing evidence or the best evidence of occurrence or validity.

WAITING TRAY.—Traveling forms are held at various stations, waiting event occurrences, in "waiting trays." Upon the occurrence of the event, the form may be dated and sent on its way, or may be dated and transferred to another lodge-ment, or may be simply changed to another tray, or to its final "filed" book, tray, drawer, compartment or box.

*OBJECTIONS TO THE USE OF WRITTEN RECORDS AND MESSAGES
IN THE FACTORY.*

Records must be written, but for factory use written records should be the fewest possible.

Man does not read written or printed inscriptions by nature, and minds liberally developed in the direction of clerklly lore are seldom coupled with sturdy workmen's bodies. Reading is an acquirement, not an instinctive function, and all factory managers well know the absolute necessity of avoiding occasion for the exercise of literary functions by workmen.

But to see, to feel, to look at things and handle them and so find out all about them, are our natural methods of obtaining information, and any means of giving factory instructions which can be used by observation, without more than a mental number and symbol notation, is far to be preferred to any indexed or tabulated form of inscriptions whatever.

Not only is the tangible object the more readily understandable, and the more quickly comprehended, but it is the more willingly studied; many, perhaps most, men dislike reading, but it is rare indeed to find a man who is not ready to use his eyes to simply look at things which he is not called upon to examine with very close attention.

It is this natural inclination to look and handle, and the equally strong natural human reluctance to study closely, which makes the card substitute for the thing, and the tray division substitute for the place, so very certain and reliable a method of recording and revealing a history, and also makes it so very difficult to devise written instructions which working men will comprehend and follow.

VISIBILITY IN THE FACTORY.

It is unquestionably a correct general proposition to say that, so far as is possible, everything in the factory should be so stored and kept as to be readily seen. Nothing whatever that will endure exposure to light should be hidden away. Stores, racks and receptacles should be as open to the eye as possible. The shop floor should be kept free from all material not in work, so that things out of place will be instantly noted. Round stock, when cut off to order in varieties and quantities,

should not be simply piled together, but should be so racked as to permit instant inspection of every piece.

In the Cottrell factory the vast number of pieces constantly in hand makes visibility a necessary condition of economy, and the greatest consideration is everywhere given to securing display and exhibition, and avoidance of covering up and hiding of things.

The Cottrell storerooms and racks are excellent examples of a good system, and show how simply and cheaply stores may be displayed by well designed racks and sheltering.

THE COTTRELL PRODUCTION ORDERS.

All production orders come from the Department of Product, and are made on form 10, which see, except orders for storeroom replenishment. The storeroom has a maximum and minimum stores limit for each item of material, and the storekeeper, informed by his card inventory of stores, sends replenishment requisitions to the production-order clerk directly, without other authorization by the department of product than is given by depletion of stores.

The production orders may be designated as follows:

1. Principal production orders, sent directly from the department of product to any factory section or department.
2. Sub-production orders, one for each component of a principal production order.
3. "S. K.," or stores replenishment orders. All components kept in stock in the storeroom have maximum and minimum limits, the storekeeper being responsible for the maintenance of numbers fixed.
4. Repair production orders, and orders for minor productions, having but few components.

PLACING THE PRINCIPAL ORDER IN WORK.

The principal production order is made on form 10, and nine copies of the principal production order are sent by the head of the department of product to the following officials: Two go to the production-order clerk, one for the clerk, and one for reference by the Head. These two copies are filled separately by the production-order clerk. One copy each is sent

to the purchase agent, the machine-shop superintendent, the storekeeper, the transfer clerk, the forge-and-foundry clerk, the smithy foreman, and the foundry foreman. Thus all the heads of departments of the factory are told that an order bearing a certain symbol and order number has been issued, calling for, say, the building of six "12K" printing presses. No detailed information is contained in this principal order, which is the personal production of the Head, and must be made with the least possible routine labor, upon receipt of a principal order. The purchase agent may at once proceed to place orders for material for these new six "12K" presses, the storekeeper may issue his requisitions for the stock parts needed, the smith may begin the forgings, and the foundry may commence on the castings, but how shall all these officials obtain their detail information? This must of course come from the drawing room, and is furnished in the form of printed lists of castings and forgings, each component bearing its own number, and the lists being headed with the principal-production symbol, "12K" in this instance. The copy for these printed lists (see form 11A) comes from the drawing room, and can only be made after the drawings are made and detailed.

THE COTTRELL DRAWINGS AND BLUE PRINTS.

The regular drawing sheet size is 41 inches long by 26 inches high.

Construction drawings cover the sheet, and are made on white paper, inked in, and traced, and for factory use are blue printed by electric light, and mounted on heavy mill boards, larger than the blue prints, with shellac varnish. The mill boards are varnished, but the blue prints are not. The mill boards might well have metallic corners, but are not so protected. These assembled drawings are little used, except in case of new or irregular constructions. The regular work is so familiar to the erectors that no assembled drawing is needed. On one side of the solitary example noted on the whole erecting floors, Nov. 11, 1902, a small blue-print card of decimal equivalents of inches and fractions was clipped, which would not have been there had the drawing dimensions been given by the metric system.

The detail drawings are so placed on the 26 by 41 inch sheets

as to permit quartering these large-sheet blue prints without mutilating piece drawings, for the purpose of making up books of blue-print details.

The symbol for each Cottrell press is a compound of a number and letter, the number giving the size of sheet the press will print, and the letter indicating the style of press. Thus, "10K" specifies a "4-roller, 2-revolution" press, to print one side of a 40-inch by 60-inch sheet. The symbol for this particular press, as a unit, is "10K." Each of the components which go to make up the completed "10K" structure has a numerical symbol only, as "35." In the "10K" press, "35" is the component number, indicating the impression cylinder, and this "35" is prefixed by the press symbol "10K," making the symbol "10K35" stand for "The impression cylinder of a 4-roller, 2-revolution press, to print a 40-inch by 60-inch sheet on one side."

Regular production routine only is here outlined, but the production forms described are adapted to all Cottrell factory productions.

Each component has a numerical symbol only, the numbers from 1 to 500 being used for castings, and 501 and upward being used for "forgings," which include all components not castings.

Besides the construction drawings on mill-board mountings, books of flat $\frac{1}{4}$ -sheet size blue prints, 13 inches by $20\frac{1}{2}$ inches, are issued from the drawing room, each containing a complete set of detail blue prints, exhibiting all dimensions of the components of one press, both castings and forgings, to all foremen who have to do with the specific order construction, and the forge shop has books of the $\frac{1}{4}$ -sheet size forgings only given it, and in addition to these books of blue prints, bound by stitching them into a stiff manila back, glued to the outer sheets, loose $\frac{1}{4}$ -sheet size blue prints, 13 inches by $20\frac{1}{2}$ inches, are issued to the department foremen for each order, and by them given to individual workmen as wanted. Blue prints are made by electric light, and one man is employed constantly in making these $\frac{1}{4}$ -sheet size books and sheets, which are replaced as often as need be.

In the drawing room complete manuscript component lists are made in leather-bound pass books, $8\frac{1}{2}$ inches high by $5\frac{1}{2}$

inches long. From these books the drawing room writes the copy from which the lists are printed.

The left hand sides of the lists sheets are perforated for the brass fasteners by which the sheets are bound into books with special canvas covers, made to order for this use. Next, to the right, comes a ruled column for the component numbers, which run from 1 to 500 for castings lists, and from 501 upward for the forgings lists; then comes the names of the components, printed at full length. At the right hand is the "S. K." column; all components having S. K. following their names are kept in stock in the storeroom, and are not produced except upon action of the storekeeper, except as specified "red line S. K." components. (See production-order clerk.)

Since these lists are in the hands of the purchase agent, the storekeeper, the forge-and-foundry clerk, the smithy foreman and the foundry foreman, these four officials may begin production on receipt of a principal production order. The purchase agent knows the condition of the factory supplies generally and can order such as may be needed for the new product. The storekeeper can see what replenishments his stock needs, and can begin them. The forge-and-foundry clerk can see that the forgings card tray, bearing the order symbol, is properly filled, and can send the tray to the smith, who can at once begin the forgings, using his book of blue-print details for his material and size directions. The foundry foreman can go to his cabinet tray bearing the order symbol, and order the patterns into the foundry and set his molders at work on them.

So far in this story, the factory has been pictured as a going concern, with supplies of all kinds on hand for immediate consumption. But these supplies must have come in by purchase, and the purchase must be paid for, and now, leaving the smithy and the foundry to produce the rough forgings and castings, the function and procedures of the purchase agent will be followed, and the purchase and payment forms described.

PURCHASE.

In case of purchase, the purchase agent turns to his card file of quotations.

Form 1. Purchase agent's quotation card. White, ruled in

made except as a charge against some "Standing Order" number. The list of titles of "Standing Orders" must, of course, vary for each factory.

Form 2 next goes to the purchase agent, whose typewriter then fills form 4, white original, form 4A, yellow carbon duplicate and form 4B, blue carbon triplicate, in accordance with the requirements of form 2. The forms 4, 4A and 4B bear the same serial number, and are supplied in pads in the usual three-color arrangement sequence. After being filled by the typewriter, all

Form 2		
Purchase Order	Department	Date
		190
Quantity	Description	
Order From		
Purpose	S. O. No.	Wanted by what date
Required by	Approved	
C. B. COTTRELL & SONS CO. REQUISITION FOR PURCHASES		

FORM 2. DEPARTMENTAL PURCHASE REQUISITION.

three copies go to the purchase agent, with form 2, which has had its purchase-order number filled in by the typewriter; 4, 4A and 4B are then visé and signed by the purchase agent, who then has four purchase forms in his hands, form 2, form 4, form 4A and form 4B. The purchase agent files form 2 in his own cabinet, in the "Orders Filled" drawer, where it serves as his authority for making the purchase. The white original, form 4, is sent by the purchase agent to the mailing clerk, the blue triplicate to the receiving clerk, and the purchase agent files the yellow duplicate in a temporary "Waiting Tray," lodged in a compartment of his desk.

When the ordered material is received by the receiving clerk, whose desk is in the storeroom, and who acts as assistant storekeeper when not otherwise engaged, he examines it, and certifies receipt and date with his signature on blue triplicate, form 4B, which he then sends to the purchase agent, who sends the triplicate to the department of plant, and removes the duplicate form 4A, yellow, to his permanent "Orders filled" four-drawer cabinet standing at the left of his desk.

Invoices come to the purchase agent, who stamps each one on its face with the rubber-stamp forms 3 and 3A, and fills the first three spaces of form 3, and fills the standing-order-number or numbers spaces in form 3A. A single invoice may be divided into allotments to different standing-order numbers. After this receipt, price, extension and standing-order certification by

PURCHASE ORDER No. _____
PRICE CORRECT _____
EXTENSION CORRECT _____
QUANTITY CORRECT _____
VOUCHER NUMBER _____

FORM 3. RUBBER STAMP IMPRESSION.

the purchase agent, the invoice goes to the department of plant, where the fourth space of form 3 is filled from form 4B, by the receiving clerk on receipt of articles as per invoice. Form 4B is held by the receiving clerk until it is wholly satisfied by receipts. It often happens, however, that partial shipments on a purchase order are received by the receiving clerk, who then fills an "interdepartment correspondence" form, form 10, with a memorandum of the partial receipt, and sends this memorandum to the department of plant, where it is filed in the "purchase orders unfilled" tray of the revolving cabinet, and held until the receiving clerk advises the department of plant of the completion of receipt, by sending form 4B, blue triplicate, to the department of plant, where it is stamped with the name of the department head, and date of receipt, and then the triplicate blue form 4B head, and date of receipt, and then the triplicate blue form 4B is finally disposed of by sending it back to the receiving clerk for filing in the storeroom cabinet, or if the purchase is not a direct

_____ to S. O. No. _____
_____ to S. O. No. _____
Form 3 A. _____ to S. O. No. _____

FORM 3A. RUBBER STAMP IMPRESSION.

<p>Form 4 Purchase Order No. 1327</p>	<p>C. B. COTTRELL & SONS CO., Westerly, R. I., _____ 190__</p>
<p>To _____ _____</p>	<p>_____</p>
<p>Please ship via</p>	<p>Delivery Required</p>
<p>ORIGINAL</p>	<p>to _____</p>
<p>IMPORTANT! Put Purchase Order No. on bill. Send bill on date of shipment to us at above address</p>	<p>C. B. COTTRELL & SONS CO.</p>

FORM 4. PURCHASE ORDER.

factory function, form 4B may be finally filed in the revolving cabinet in the department of plant in the drawer marked "purchase orders filled."

Form 3. Engraving full size, rubber-stamp impression, printed in red ink on the face of every invoice received by the purchase agent. (See form 2, text.) First three spaces filled by purchase agent, last two spaces filled by head of department of plant.

Form 3A. Full size. Rubber-stamp impression, printed in red ink on the face of every invoice received by the purchase agent. (See form 2, text.) Standing-order spaces filled by the purchase agent from his yellow form 4A.

Form 4. White bond paper, printed in black. Serial number in red. Size, $7\frac{7}{8}$ inches long by $4\frac{7}{8}$ inches high.

Filled by purchase agent's typewriter from form 2. Form 4 is the original, and is sent by the purchase agent to the mailing clerk, to be forwarded to the source of supply. This is the only purchase form that leaves the factory. The purchase agent retains the yellow duplicate, and the blue triplicate goes to the receiving clerk, located in the factory storeroom.

By the use of forms 2, 3, 3A, 4, 4A, and 4B, any department head may make a purchase requisition, but only the head of the department of plant can vitalize it. The purchase agent only can order purchases. The department of plant and storeroom are notified of all purchase particulars as soon as the purchase order is made. The department of plant is immediately informed of the receipt of any part of an order, or of the complete order; so far the factory is safe; it has the commodity ordered, either actually or constructively in the storeroom, as its presence is vouched by the signature of the receiving clerk, who is the storekeeper's assistant, and all of these functions and results are obtained by a single writing of the purchase order on form 4, which is mailed to the source of supply. Form 4 must be written, as there must be some written evidence of every business transaction; hence these purchase forms involve the least possible clerical labor, while at the same time they give full information to all concerned, and chronicle every event connected with any purchase, from the instant the purchases are authorized by the department of plant, to the receipt of the purchased ma-

terial by the receiving clerk. For payment details, see form 6 and its functions.

Form 4C. Material Received Card. White, printed in black. Size, 5 $\frac{7}{8}$ inches long by 4 inches high.

This form is a notification from the receiving clerk in the storeroom to the department of plant, announcing receipt by storeroom of components produced in the factory.

Storeroom receipts by purchase, which have had no factory labor, are received by the receiving clerk, who notifies the department of plant on the interdepartment correspondence form,

Form 4C. Required for		Section	Foreman	Date	190
Quantity	Description				Value
On Purch. Order					
Rec'd by					
MATERIAL RECEIVED CARD. C. B. COTTRELL & SONS CO.					

FORM 4 C. MATERIAL RECEIVED CARD.

10, if the receipt is partial, or by sending form 4B, blue triplicate, to the department of plant if the receipt entirely satisfies the purchase order.

Everything in the storeroom falls into one of two specifications of procurement, being either purchased as stored and having no factory labor increment of value, or else being a factory product. Form 4B advises the department of plant in regard to stores produced outside of the factory, and form 4C tells the department of plant of factory-produced stores received in the storeroom.

Form 5							
VOUCHER							
Date	Voucher Number	NAME OF CREDITOR	Total Amounts	Date Paid	C. B. Folio	Check Number	
1		<i>Amount Brought Forward</i>					
2							
3							
4							
5							
6							
7							
8							

RECORD							
50							
DISTRIBUTION				General Accounts		ITEM	
							1
							2
							3
							4
							5
							6
							7
							8

FORM 5. VOUCHER RECORD.

The two parts should be joined along the vertical lines between "Voucher" and "Record." Only 8 of the 50 horizontal lines of the original are here shown. The words "Carried Forward" are at the bottom of the original.

Form 5. Voucher Record. Heavy white sheet, ruled in red, printed in black. Perforated at top. Size, $18\frac{7}{8}$ inches long by $11\frac{7}{8}$ inches high. In the engraving, this form is divided into two parts, and only eight of the fifty horizontal lines are shown. At the bottom of the original form are the words "Carried Forward."

Filled by cashier from invoices as received from department of plant. If dated with check number the account is settled. "Total amounts" and "distribution" totals balance.

This is not directly a cost form, but the compiler shows, in this instance, most of the counting-room forms, as they are convenient ones and are in the most modern style.

This form gives the total of invoice indebtedness readily.

The vouchers are bound in a binder, the cover opening away from the user, and leaving the removable sheets perfectly flat.

The invoices are finally filed serially by vender's numbers, as applied by factory, all bills from one vender going in one envelope, card indexed.

Form 6. Purchase Voucher. White bond paper, blue and red ruling, black print. Size, $7\frac{7}{8}$ inches long by $4\frac{7}{8}$ inches high.

This form is filled by the cashier from invoices received from the head of department of plant; the invoice is then filed alphabetically in the unpaid invoice file in the cashier's room. Each vender has an individual form 6 filled for each month, and a check is made each month to satisfy the totals of form 6, the check being printed with "In payment of voucher No.," followed by a space filled with the form 6 number. If this check is cashed the account is satisfied. (See advices at foot of form 6A.) Form 6 is totaled and dated at the end of each month and placed in the unpaid file. Where invoices are paid oftener than monthly to obtain early payment discounts, a separate voucher form 6 is made for each due date and check, covering invoices from date of last check. Checks are drawn to satisfy unpaid invoices at stated periods, or at the order of the head of department of plant, who alone signs checks.

When form 6 is filled down to the certification space it is sent with invoice or invoices by the cashier to the office manager, whose desk is in the department of plant, who compares the filling with the invoice totals, and certifies correctness by his signa-

[illegible]

FORM 6. PURCHASE VOUCHER.

ture. He returns the invoice or invoices to the cashier, and sends certified form 6 to the head of department of plant, who authorizes the drawing of a check to cover the invoice by writing his signature in the "Approved" space, and then returns form 6 to the cashier, who writes the check and sends check and voucher to the department of plant, where the head signs the check. Then form 6 and the check are returned to the cashier, who applies the "check protector" stamp "not over" the nearest \$10.00 excess, to prevent check raising, and the check then goes with form 6A to the mailing clerk. (See form 6A.)

When form 6, approved, and the invoice or invoices are re-

[illegible]

FORM 6 A. PURCHASE VOUCHER REMITTANCE SLIP.

turned to the cashier from the department of plant, the cashier stamps the invoice or invoices "paid" with a dating rubber stamp, and files all invoices by the "vertical file" system in a cabinet, which keeps each firm's correspondence separate.

Form 6 is finally filed alphabetically in a "paid voucher" tray, for reference as required, in the cashier's room.

Form 6A. Purchase Voucher Remittance Slip. Carbon copy of form 6. Ruled in red and blue, printed in black. Same size and material as form 6. Perforated at right of ruling to remove factory account title in carbon.

Form 6A is filed with form 6 in the cashier's tray marked "purchase orders unpaid," until the date of check drawing, when it is given the check number and date, and is sent by the cashier with the check to the mailing clerk.

Because form 6A is a carbon copy of the typewritten text of form 6, it bears at the right of the ruling the typewritten text of form 6; this should not go to the receiver of the check, as it is not his business, and form 6A is therefore parted at the line of perforations at the right of the ruling, and the detached right hand part is destroyed.

Form 8. Order No.		To Section Foreman		Date 190	
Quantity	Description				Value
Delivered by		Received by			
Only one item on a card MATERIAL RETURNED CARD. C. B. COTTELL & SONS CO.					

FORM 8. MATERIAL RETURNED CARD.

Form 7. Check Register. Heavy white sheet, ruled in red and blue, printed in black. Size, $11\frac{3}{4}$ inches long by 9 $\frac{1}{2}$ inches high. Only part of the horizontal lines are shown in the engraving.

Every check drawn is registered on form 7, by the cashier. Form 7 is bound in binders, and the book is in charge of the cashier. The credit side of cash avoids the necessity for writing check stubs. Form 7 records all information given by old style cash book and check stubs.

Form 8. Material Returned Card. Salmon color; thin

[illegible]

FORM 9. FRONT. STORES LEDGER OR INVENTORY CARD.

[illegible]

FORM Q. BACK. STORES LEDGER OR INVENTORY CARD.

paper. Ruled and printed in black. Size, $5\frac{7}{8}$ inches long by 3 15-16 inches high.

This materials-returned form is used to re-house in the storeroom any surplus or erroneously requisitioned stores from the factory or from the erection superintendent. It is filled by the section foreman or erection superintendent, and presented with the material to the storekeeper, who inspects the material, and certifies quantity, number or weight, and condition, and places the material in storeroom, and enters record on stores "ledger" or inventory card, which records values, and then sends form 8 to the factory cost clerk. It happens that, excepting grease, no weights are noted in the Cottrell storeroom.

Form 9. Front. Stores ledger, or inventory card. Stiff white card. Ruled in red and blue horizontally, black vertically. Size, $5\frac{7}{8}$ inches long by 4 1-16 inches high. These cards are filled by the storekeeper from personal knowledge of stores receipt and disbursement, and are filed in two four-tray card cabinets, kept one at each end of the storekeeper's desk. These cards are always correct to within 24 hours of inquiry.

The "Ordered" spaces are for record of storekeeper's requisitions made to keep his stock up to designated supply.

Prices are entered by the cost-keeper as given by the cost clerk, if relating to a factory product, or from invoice if the material is purchased complete.

Form 9. Back. The same as front, except title and specification; both front and back are used for records of the same unit.

"PRINCIPAL," "S.K." AND "R" PRODUCTION ORDERS.

There are three forms of production orders recognized in this factory organization, as follows:

First, the "Principal production order" simple, which calls for the production of an entire machine, commonly some sort of a printing press. These principal production orders are designated by the order number only, with no prefix whatever.

Second, "Stockroom" or storeroom stores or "stock" production orders, which are issued for factory-stores production of components used in the production of "P" orders; in other words, for "P" repetition details made in quantities and always in store.

Third, "Repair" orders, abbreviated to "R" orders, for minor

factory productions, sometimes with an increment of factory labor, sometimes without.

This gives plain numbered orders, always involving factory labor, and "S.K." orders, also involving factory labor, and "R" orders which may or may not demand service of factory workmen.

Form 10. Internal correspondence form for all purposes. Light bond paper. White, printed in black. Size, $7\frac{7}{8}$ inches long by 4 $15-16$ inches high.

	SUBJECT _____	DATE _____
	To _____	

FORM 10. DEPARTMENTAL CORRESPONDENCE, USED AS A PRODUCTION ORDER.

It is obviously convenient for the factory to have some one stores requisition form by the use of which any foreman may procure material from the storeroom to be used in filling any form of production order, and such a general requisition is shown in form 11, which notes the particular form of production to which it conduces by writing the order number with no prefix, or by placing "S.K." or "R" before the number in the upper left hand corner.

Form 11. Material Delivered Card. Buff; printed in black. Size, $5\frac{7}{8}$ inches long by 3 $15-16$ inches high.

Form 11 may be described as the general departmental

storeroom requisition. It is filled by any department foreman in process of filling production orders of either sort. After the delivery of material, form 11 is filed for the day only on a hook at the right hand end of the receiving clerk's desk in the storeroom. The next morning the stores disbursement having been entered on the stores card-ledger file, forms 11 are sent to the cost clerk. The "value" spaces are filled by the storekeeper where the stores ledger gives the component a value. From reasons of policy, some stores are not priced on the stores ledger, but on the purchase agent's card files only, although all material

Order No.		To Department		Foreman	Date	190
Quantity	Description				Value	
				Entered on Stores Ledger		
Delivered				Received by		
C. B. COTTRELL & SONS CO.				MATERIAL DELIVERED CARD.		

FORM 11. GENERAL DEPARTMENTAL STORES REQUISITION.

in the Cottrell factory is constructively, at least, in the storeroom and in charge of the storekeeper.

Upon receipt of forms 11 from the storeroom, they are vised by the cost clerk, and those having item value spaces unfilled are sent to the purchase agent, who fills the vacant value spaces.

Finally, forms 11 are bunched into rubber-banded weekly bundles, and filed in date sequence in boxes at the right hand end of the cost clerk's desk.

MACHINE-SHOP PRO-
DUCTION ROUTINE.

Having now described supply purchase, and shown payment forms, located the storeroom, and shown how stores are obtained from it, and, in case of erroneous requisition, are returned to it, matters are in form to proceed with the details of the machine-shop production routine, beginning with lists, form IIA, by the aid of which the production-order clerk, the storekeeper, the transfer clerk and the forge - and - foundry clerk are enabled to supply the machine shop with rough material, and by which the transfer clerk is enabled to make a complete history of all the great number of different operations needful to turn the completed principal order over to the shipping clerk. Every piece produced must

LIST OF PARTS NEW PRESSES.			K
SUB. NO.	NAME OF PART		
	CASTINGS.		
1	1 Side Frame-Right,		
2	1 " " Left,		
2 $\frac{1}{2}$	1 Rear Tie,		
3	1 Base,		
3 $\frac{1}{2}$	1 Front Tie,		
4	1 Track,		
5	2 Track Supports,		
6	2 " "		
6 $\frac{1}{2}$	1 " "		
7	3 " "		
7 $\frac{1}{2}$	4 " "		
8	1 Yoke,	S.K.	
9	1 " Box, 2 pieces,	"	
9 $\frac{1}{2}$	1 " " Cap,	"	
10	1 Outrigger Base,	"	
11	1 " Stand,	"	
12	2 Slider Gear Shield,	"	
13	1 K. Shaft Bearing,		
14	2 Long Track Support,		
15	1 Cam Conn. Collar,	S.K.	
16	1 Rackchanger,		
17	2 Air Chambers,		
18	1 Rack Guide,	S.K.	
18 $\frac{1}{2}$	1 " Cap,	"	
19	1 Rocker Shaft,	"	
20	1 Bed,		
21	1 Ink Table,		
22	2 Toggles,	S.K.	
23	1 Cam Connection,	"	
23 $\frac{1}{2}$	1 Vib. Cam Collar,	"	
24	2 Rocker Shaft-Boxes,	"	
24 $\frac{1}{2}$	4 " " Caps,	"	
	Carried forward,		

FORM II A. PRINCIPAL ORDER COMPONENT LIST.
"CASTINGS" FORM.

have its production order, and these production orders are made by the production-order clerk from the lists.

Form 11A. List of Parts. White paper, red and blue ruling, printed in black. Bound in canvas-covered boards, "Cottrell" special loose-leaf binder with two two-prong brass sheet fasteners. Size of covers, $4\frac{1}{4}$ inches long by $10\frac{1}{4}$ inches high. Size of sheets, $3\frac{7}{8}$ inches long by $9\frac{7}{8}$ inches high. The covers will hold 50 sheets, each having 32 individual component spaces, making a total of 1,600 component spaces, if so many were required, in one of these small and extremely convenient volumes of "lists of parts."

These lists of parts for each principal construction order are supplied to the erection foreman, transfer clerk, storekeeper, and, generally, to all foremen who have to do with the production of the order, as the books cost very little, are durable, and give the name and number of every component. Nothing adds more to certainty in the production of machines having a great number of parts, than such clearly printed component lists in the hands of all who are directing labor.

Books of forms 11A are not often renewed, but may be easily made good in case of damage, as the leaves are detachable.

It should be here said that it is common practice, even in large factories, to use regular production lists of parts written in manuscript.

This Cottrell printed list of parts bound as described, gives a list form worthy of careful consideration.

The factory operations so far detailed result directly from the entrance of the principal order, which authorizes the purchase of supplies, and the making of the needful forgings and castings, which are sufficiently specified by the lists and blue prints, and may be completed in the rough, ready to go into the machine shop when ordered there by the head. The smithy time cards go to the paymaster and then to the cost clerk, and charges are made against the order in regular course.

But at this point something more must be done. The storekeeper must see that his stores can meet the requirements of the principal order, the castings and forgings weights and kinds must be noted, and machine-shop labor must begin on the stores-

replenishment orders, and the multitude of sub-production orders must be made, so that detailed costs can go to the cost clerk.

These component costs are subdivided into operation costs by the factory subdivision into departments, or "Sections," as they are named on the Cottrell chart of authority, which see, and by the use of differing time cards for each different factory section.

These detail operations begin with the production-order clerk, who, as before mentioned, is acting private secretary to the Head so far as the factory interior is concerned, and in that capacity analyzes the cryptogram principal orders issued by the Head on forms 10, and translates them into ultimate production units, each under its factory name, and writes a sub-production order for each individual unit or lot of similar units or components.

The transfer clerk receives all the sub-production orders made by the production-order clerk, and from these sub-production orders the transfer clerk fills forms 16A for making requisitions on the forge-and-foundry clerk for rough forgings and castings, the weights and dates on forms 16A being filled by the forge-and-foundry clerk, who sends the rough forgings and castings into the machine shop upon receipt of "in work" orders from the Head, given as follows: It has already been explained that nine carbon copies are made of each principal production order on form 10, and that two of these go to the production-order clerk, one filed in the permanent production order file kept for reference by the head, and the other held in temporary lodgement by the production-order clerk, while purchases are made, store-room replenishments are ordered, and castings and forgings are produced.

These preliminary productions being supposedly complete, and the machine shop being ready to take on the new job, the Head then simply signs his name to the single copy of the principal order held by the production-order clerk; this signed order is then sent without loss of time to the transfer clerk, who is thus formally notified that the order is in work. The transfer clerk then immediately forwards the same signed principal-production order to the forge-and-foundry clerk, who at once proceeds to transport the forgings and castings from the smithy and the

foundry yard to the machine shop, accompanying these rough components with their requisitions, made on form 16A, already filled and sent to the forge-and-foundry clerk by the transfer clerk, and which now return to the transfer clerk's desk, with weights and machine shop entry date added, and are sent from the transfer desk to the cost clerk daily. The forge-and-foundry clerk returns the principal production order signed by the Head to the latter, when the forgings and castings have all been delivered to the machine shop. The Head vizes this returned principal order, which notifies him that the shop has all the rough components demanded by the order, and then returns this solitary signed principal production order to the production-order clerk, who files it permanently in his own principal-order tray.

When the production-order clerk sends the "in work" mandate to the transfer clerk, he also fills form 12B, for want of a special form for this purpose, with a notification, as shown filled in form 12C, and personally delivers form 12C, so filled, to the machine-shop superintendent, thus completing the important function of placing the principal order in work in the machine shop.

The signed principal order might go first to the machine-shop superintendent, then to the transfer clerk, then to the forge-and-foundry clerk, thus avoiding this chance use of form 12B filled as shown in form 12C. But the "in work" order is of first importance to the machine shop; the transfer clerk is not subordinate to the machine-shop superintendent; the direct method is to send the "in work" order from the head to the transfer clerk, who directs the sequence of machine-shop functions, and the direct method is followed, although it involves the ellipsis of form 12C. All of this brings the production-order clerk, the transfer clerk and the forge-and-foundry clerk into the foreground.

THE PRODUCTION-ORDER CLERK.

The production-order clerk must be familiar with the factory product, and should know the lists thoroughly. It is greatly to his advantage to be a machinist and to have been in the shop for a considerable time. His work is almost purely clerical, but his general knowledge of the factory routine should be good.

The production-order clerk has complete lists of all principal-

production parts, and knows which components have the most work on them. His desk has telephone communication with all the factory officials.

Upon receipt of a principal order the production-order clerk proceeds to fill component production orders for the entire components of the list bearing the order symbol, except those which are made on requisitions made by the storekeeper on the production-order clerk.

"RED-LINE" S. K. COMPONENTS.

As previously stated, (see "lists"), components followed by "S. K." are supposed to be kept in stock in the storeroom, and as the storekeeper makes requisitions on the production-order clerk for stores replenishment, regular procedure would make all S. K. orders follow the storekeeper's requisition on the production-order clerk. It has, however, been found advisable to select certain of the S. K. components having most work on them, distinguish these selections by drawing red lines in the S. K. column, and place these red-line marked components in direct charge of the production-order clerk, who makes sub-production orders for the red-line S. K. components of a principal order first of all. The lists held by the storekeeper are red-line marked, the same as those held by the production-order clerk, and the storekeeper pays no attention to the red-mark S. K. components, while the production-order clerk makes his first production orders for the red-line S. K. components, which are those requiring considerable time for production. S. K. orders are "in work" without a special "in work" order, as soon as the production order for them reaches the transfer clerk, consequently the red-line S. K. components go into the machine shop at the earliest possible moment.

This is an excellent feature, and this whole system is made flexible and accommodating by the two forms of production orders. S. K. orders are in work as soon as issued, regardless of their principal order number, because all S. K. orders are worked as rapidly as may be. But in case an S. K. production-order number is preceded by a principal-order number, the finished component is not sent by the transfer clerk to the general storeroom, but to the "waiting" storeroom, and is there held until required for its principal-order number on the erecting floor.

The S. K. mark alone was intended to advance component production sufficiently to meet all cases, but it often happened that S. K. components were not ready as soon as wanted. The red mark cured this evil, by ensuring the earliest possible beginning of work on the red-marked S. K. components.

S. K. PRODUCTION ORDERS.

These are storeroom replenishments made by the storekeeper's requisition on the production clerk, and cover all S. K. orders not red-lined.

The storekeeper makes his requisition on form 15, which see, and the production-order clerk fills sub-production or single component production S. K. orders for them, with S. K. "tracers." (See form 15, text.)

The only functional difference between an S. K. order and a principal-order sub-production order, is that the S. K. order is in work as soon as it reaches the transfer desk, while the non-S. K. sub-production order is not in work until the principal order is put in work.

SUB-PRODUCTION ORDERS.

These are made by the production-order clerk for each component of a principal-production order, or for each lot of similar components, using form 12, pale yellow, form 12A, pink, or form 12B, green, as may suit.

Form 12. Production Order and Transfer Card. Stiff yellow card, printed in black. Size, 2 5-16 inches long by 3¼ inches high.

Forms 12, 12A, 12B, 16, 16A, 17, and 20, green, are each both production orders and transfer cards, having double functions. The first function is that of production. Each of these cards orders the production of a component.

The second function of these cards, except 16A, is to accompany the product through the factory departments, and act as a passport and identification. No department will receive any component in process of production from any other department, unless it is accompanied by its individual passport or way bill, which is also its production order.

Form 12 is filled in manuscript from printed "lists," by the

production-order clerk, at his desk in his room in the factory office building. This desk has both telephone and "buzzer" connections with all heads of departments, and with the factory messenger.

Form 12 is filled in accordance with typewritten orders made on form 10, (see text), authorized by the head of the department of production, and sent to the transfer clerk, at his transfer desk, near the centre of the machine floor.

Form 12 is used for components of the "2-revolution" presses only.

Form 12A, a pink stiff card of the same size and text as form 12, serves the same purposes as form 12, but is used for "Rotary" presses only. It is filled by the production-order clerk, and sent to the transfer clerk.

Form 12B, a green stiff card, of the same size and text as form 12, serves the same purposes as form 12, but is used for drum presses and "color" rotary presses and special or irregular small press components. It is filled by the production-order clerk, and sent to the transfer clerk.

Form 12C is similar to form 12B, and is an "in work" notification to the machine shop superintendent. It is filled by the production-order clerk, and by him personally given to the machine shop superintendent, by whom it is filed in a card tray standing on his desk, and finally destroyed when the principal order is shipped.

Form 13. Front. "Waster" Report. Light stone color,

Order No.
Quantity.
Description of work.
Pattern.
To Section. PRODUCTION ORDER AND TRANSFER CARD.

FORM 12. PRODUCTION ORDER AND TRACER.

heavy paper; printed in black. Size, $5\frac{7}{8}$ inches long by 3 15-16 inches high.

This is filled by the foreman of the department where the fault is discovered. When a piece is found to be spoiled, the foreman who fills form 13 must go to every department through which the waster has passed, and obtain and record the time put on the piece in each department, and must also give the weight of the spoiled piece. All the entries made by the department foreman go on the front of form 13. After filling as described the foreman sends form 13 to the cost-keeper, who fills the back of form 13, which see.

Form 13. Back. Printed in black. This is filled by the cost clerk, from the flat cost items and other information recorded on the front by the foreman of the department. The cost clerk then notifies the department of product by sending to it form 13, filled back and front, and the department of product orders the replacement material into the factory, using form 12, 12A or 12B, as the case may be. This places two component requisition forms, 12, 12A, or 12B, in the tray belonging to this particular order, and so carries a record of the "waster" through to the final costing of the order number.

The cost-keeper adds factory charge percentage to flat cost, and places the waster cost at factory product price.

Form 14. Collective component tracing and locating. White paper; blue and purple ruling; printed in black. Size, $7\frac{7}{8}$ inches long by $9\frac{7}{8}$ inches high.

This form gives the present time location of any component, either casting or forging, of any single principal order in process of production. Two forms are used, identical save as to the words "forging," which appears on one, and "castings," which takes its place on the other. It is filled by the production-order clerk from detail production orders, and sent to the transfer clerk, who notes, by writing the date in the department squares, the entrance of any component into any department. Thus form 14 contains a complete dated history of the arrival and travels in the factory, of each component recorded, and consequently tells in what department it rests at the moment of inquiry, and the consequent stage of progress.

Form 14A. Cost statement. White paper. Ruled in red

CASTINGS					
No.	NAME	Size	PAT. MARK	SECTION NUMBERS	DATE FINISHED
1	Side frame, R				
2	" " L				
2 ¹ / ₂	Rear tie,				
3	Base,				
3 ¹ / ₂	Front tie,				
4	Track,				
4 ¹ / ₂	End piece,				
4 ¹ / ₂	" "				
5	Track support,				
6	" "				
6 ¹ / ₂	" "				
7	" "				
7 ¹ / ₂	" "				
8	Yoke,				
9	" box,				
9 ¹ / ₂	" " cap,				
13	Inside knuckle shaft bear,				
14	Track supports,				
14 ¹ / ₂	Bed rolls,				
15	Bed roll stands,				
15 ¹ / ₂	" " oil pan,				
16	Rack hanger,				
17	Air chamber,				
19	Rocker shaft,				
20	Bed,				
21	Ink table,				
23	Cam. conn.,				
24	Rocker shaft boxes,				
26	Track caps,				
27	Sliders,				
28	Gibs,				
29	Gib supports,				
32	Feed guide brackets, R				
33	" " " L				
34	Vib. rack shield,				
35	Cylinder,				
36	Cylinder shaft boxes,				
37 ¹ / ₂	" " caps,				
38	Lifting shaft collars,				
39	Rack hanger guide,				
41	Middle bear,				
42	Bed shield,				
43	" "				
50	Feed table bracket, R				
51	" " " L				
52	" " standard, R				

FORM 14. PRINCIPAL ORDER TRACING AND LOCATING FORM.

and blue; printed in black. Size, 7 15-16 inches long by 9 7/8 inches high.

The list of part names is printed from copy furnished by

COST STATEMENT									
NEW PRESSES									
K									
SUB. NO.	NAME OF PART	ORDER NO.	ORDER NO.	ORDER NO.	ORDER NO.	ORDER NO.	ORDER NO.	ORDER NO.	ORDER NO.
		COST	COST	COST	COST	COST	COST	COST	COST
	CASTINGS								
1	1 Slide Frame-Right,								
2	1 " " Left,								
2 1/2	1 Rear Tie,								
3	1 Base,								
3 1/2	1 Front Tie,								
4	1 Track,								
5	2 Track Supports,								
6	2 " "								
6 1/2	1 " "								
7	3 " "								
7 1/2	4 " "								
8	1 Yoke, S.K.								
9	1 " Box, 2 pieces, "								
9 1/2	1 " " Cap, "								
10	1 Outrigger Base, "								
11	1 " Stand, "								
12	2 Slider Gear Shield, "								
13	1 K. Shaft Bearing,								
14	2 Long Track Support,								
15	1 Cam Conn. Collar, S.K.								
16	1 Rackhanger,								
17	2 Air Chambers,								
18	1 Rack Guide, S.K.								
18 1/2	1 " Cap, "								
19	1 Rocker Shaft, "								
20	1 Bed,								
21	1 Ink Table,								
22	2 Toggles, S.K.								
23	1 Cam Connection, "								
23 1/2	1 Vib. Cam Collar, "								
24	2 Rocker Shaft Boxes, "								
24 1/2	4 " " Caps, "								
	Carried forward,								

FORM 14 A. PRINCIPAL ORDER COMPONENT COSTS.

the drawing room. The form shown is a castings list. Forging lists are in the same form, with "forgings" in place of "castings." Forms 14A are provided to list all components of all Cottrell

factory productions, and are on separate sheets, pierced at the left for binding. The seven order-number columns provide space for recording costs of productions for seven dates of the same component and the same line, thus giving instant cost comparisons for different date constructions.

Form 14A is filled by the cost clerk from factory labor and storeroom records. The bound volumes are kept by the cost clerk.

Form 15. Stores Replenishment Requisition. Thin manila

S. K. No. _____	
Section _____	Storeroom _____
Date _____ 190	
Requisition for _____ Order No. _____ for _____	
Quantity in Stock.	
Storekeeper. _____	

FORM 15. STORES REPLENISHMENT REQUISITION.

paper; printed in black. Size, 5 11-16 inches long by $3\frac{7}{8}$ inches high.

This form is filled by the storekeeper, in pencil, with a carbon duplicate, and both original and duplicate go to the production-order clerk, who, without other authority, proceeds to fill "S. K." production-order cards, (see form 16), to satisfy form 15, and fills the "S. K. order No." space with the S. K. production-order number. Then the original returns to the storekeeper, who holds it as a dated voucher for his performance of duty, and the duplicate goes to the machine shop superintendent, and the satisfying S. K. forms 16 go to the transfer clerk.

Upon receipt of forms 15 from the production-order clerk, the machine-shop superintendent examines them and directs the department foremen as to which shall take precedence in production. Form 15 gives the number of components, or "none," in storeroom, so that comparative urgency of demand is evident.

When completed components to satisfy form 15 reach the transfer clerk, he takes the duplicate form 15 from the machine-shop superintendent, and sends it with the satisfying components to the storeroom, where the storekeeper compares his original with the components received, makes his storeroom card-ledger entries, and then destroys both original and carbon duplicate of forms 15.

At the same time that the transfer clerk sends the completed components and form 15 to the storekeeper he takes the S. K. order to satisfy form 16, which see, which has come back to the transfer desk with the completed components, and the corresponding S. K. white "tracer" form 17, which see, from the final "section" or "department" tray, and places them together, in bundles of the day's completed component receipts at the transfer desk, and binds the bundle with rubber bands, so that corresponding forms 16 and 17 will remain in juxtaposition, and sends this bundle of completed sub-production orders and "tracers," forms 16 and 17, to the cost-keeper. Forms 17 have on their fronts the component symbol, and on their backs a full dated story of all that has been done, and when and where it was done, in producing the component. Thus the cost-keeper obtains the whole factory history of each component the day, or the day after, the component is received by the storekeeper, and is then informed of the completion of the S. K. production order, form 16.

Form 15 is filled for each separate component in any number, except in case of a "Compound Component," consisting of an assemblage of simple parts. In case of the compound component, form 15 may call for several different units, all to be finally assembled to form a complete compound component in any number.

Form 16. S. K. Production Order. Stiff red card, printed in black, with "S. K." rubber-stamp impression. Size, 2 5-16

inches long by $3\frac{1}{4}$ inches high. Except color and "S. K." stamp, this form is similar to form 12, and is not engraved.

This is issued by the production-order clerk on storekeeper's requisition or from "red-line" intimation, made on form 15, which see, and sent by the storekeeper to the production department. "S. K." means "storeroom stock." The first line, following "S. K." is filled with the component symbol. The description of work space is filled with a specification clearly indicating the blue print to be used.

Where large numbers of a single component are ordered at once, it is the custom to fill a number of duplicate S. K. forms 16, so that the work can pass through the departments in convenient lots.

The production-order clerk sends forms 16, when filled, to the transfer clerk, who then proceeds at once, as detailed later, to place the S. K. production orders in work, without favor or discrimination. The factory superintendent instructs the department foremen as to which S. K. order shall be hurried.

S. K. production orders are also made by the production-order clerk to satisfy requisitions from the department of production to meet correspondence orders, form 10, which see, being used as informant to the production-order clerk, as before.

THE TRANSFER CLERK.

The Cottrell machine shops, as shown in the plan, form an irregular cross, the main member about 400 feet long, east and west, and 100 feet wide, and the transverse members 165 by 56 feet on the south, and running 91 feet to the north, this north member being 56 feet wide next to the main structure, so that altogether there is about 700 feet of machine shop length. As these floors are arranged, with the transfer clerk's desk in about the middle, a radius of 200 feet covers the shops, with the transfer office as the center, and so brings the transfer desk within a reasonable distance from every factory department.

This transfer desk, constitutes a factory "clearing house," which receives every production order from the office, all castings from the foundry, all forgings from the smithy, all shafting and rods from the cutting off machines, and in short, all rough stores materials for filling all production orders in metal.

Production orders to be filled in wood go to the pattern shop, and are not in any way handled by the transfer clerk. Everything not of wood, is received into the factory, placed in the first operation department, and traced through the departments to completion, by the transfer clerk, who keeps records of the S. K. component movements by cards standing in trays in the "department tracing" cabinet, and can at any time locate any piece in any stage of progress in the factory. When components made on sub-production orders are finished, they go to the transfer clerk, who sends them either to the storekeeper, to the waiting stores, or to the erector who should have them, as may be, always keeping a record of the present location of each individual component up to the time of completion of the principal order.

The transfer clerk has a desk with ample room for two writers, two high chairs, and a cabinet for holding "department tracer" trays. (See also "Tracing Scheme.") The transfer desk is not enclosed, but standing room and the "department tracer" cabinet are railed in, the desk being freely accessible to workmen and messengers in front. The transfer clerk's desk is furnished on top with "in" and "out" baskets, as are all other desks in the factory and offices, and has, in addition, first, a three-compartment box in which any questionable card is placed for the instant; second, a grooved tray, the same as section-cabinet trays, in which S. K. and other sub-production orders stand on end, with their symbols towards the clerk; third, a box with numerical index cards between which tracing copies of sub-production orders made on form 19A are filed until the satisfying components are completed; fourth, always some paper bound books of principal-order component tracing sheets, form 14; fifth, another three-division box, used to hold the sub-production orders, bunched and banded under principal-order numbers, of principal-order components which have been completed, and tagged with the principal-order number, and sent to the "waiting stores" until wanted on the erecting floor, when the components are taken out of waiting stores and sent with their original sub-production orders to the erector; sixth, another three-division box used to hold the day's receipts of the forge-and-foundry weight and date cards, forms 16; also, red and

black ink stands and pen racks, a rubber dating hand stamp and ink pad, and a small memorandum daily calendar pad.

The S. K. and sub-production order grooved "tray" is a wooden base having two rows of 50 saw cuts each, making 100 narrow grooves in which stiff cards can stand upright. These grooves are wide enough to take 4 cards in each, so that if crowded the waiting tray could hold about 400 cards. In use the tray has usually about 150 cards in it, sometimes more, sometimes less.

There is one transfer clerk, one transfer assistant clerk, and one transfer laborer, who handles material at the orders of the transfer department.

The transfer clerk has no authority over operatives, other than his assistant and his laborer, and cannot originate any shop procedure; but he can and does give out production orders for department operations. In case a department objects to performing an operation, appeal lies to the machine-shop superintendent, who always sustains the transfer clerk with the result that appeal is very rare indeed. Of necessity the transfer clerk knows the condition of every department, and may use either lathes or boring mills, or milling machines or planers, as the departments are full or slack. The transfer clerk also knows what is coming along, and so is perfectly prepared to act in the capacity of assistant machine-shop foreman, so far as placing operations is concerned. He does not rank as a foreman, but he does perform many of the duties which usually fall to the assistant superintendent, or general foreman.

THE TRACING SCHEME.

The general scheme of the S. K. "components in progress" tracing, is to substitute small stiff cards bearing the S. K. component order number and symbol for the component itself, and to substitute boards with sawcuts, like the "waiting tray," for shop departments. When the actual component enters the actual department, the card component substitute is placed standing, so as to expose the order number and the component symbol, in the tray marked with the name of the department. When one department finishes its operation on the component in progress, the component production order goes to the transfer clerk, who

then makes his selection of the department to perform the next operation, and changes his S. K. tracer in the department tray, marking the change date on the card back, and sends out the production order accordingly.

ACTUAL COMPONENT TRANSFER.

Every department, as a matter of pride, is prompt in notifying the transfer clerk of operation completions. No department head covets the reputation of dawdling. Each department has a helper, one of whose duties is the clearing of the department of worked components. Upon operation completion the helper carries the component S. K. production order to the transfer clerk, who changes the "tracer" from one section to another, marking the date of change and new section number on the back of the card, and tells the helper where to deliver the S. K. production order and the components it represents. No department will receive anything unaccompanied by the production order, and no department can rid itself of any piece of material whatever without having a production order to go with it.

All of this makes the transfer clerk's S. K. cabinet of department trays hold precisely the same S. K. card substitutes, bearing order number, symbol and department entrance date, as there are actual S. K. components to correspond, accompanied by production orders, in the actual departments or sections.

So far this scheme traces every component made on an S. K. production order, but this is not enough. It is highly important that the present location of all the sub-production components that go to make up a principal production order should be known.

To meet this principal-production order requirement the transfer clerk uses forms 14, which see, for castings or forgings or both, as may be required, and fills "section" number spaces with manuscript records of the day and month of component entry into the factory section or department. Thus the department S. K. cabinet trays with their cards standing upright tell all the stock components in any section, while the manuscript entries on forms 14 tell where every other component of any principal order, which is under sub-production order construction, is lodged at the instant of inquiry.

It is always difficult, in any factory, to keep track of work in progress, and where there are such great numbers of components in each principal production as in the Cottrell presses, this task is far beyond the powers of any human mind, and expensive and irritating confusion often comes from not being able to find pieces which undoubtedly went into the factory. It seems certain that this tracing system must interest factory managers, and it is therefore fully detailed here.

The effect of this "transfer" and "tracing" is to enable any painstaking clerk, who is familiar with a certain factory, to ideally fill the next position below that of factory superintendent. The first requisite for ideal perfection in this important place, is an all-inclusive, never-failing memory. Probably no training could enable any man to certainly remember all the different articles in work in the Cottrell factory at once, and where each one of the several thousand different components was located at any past date, or is placed at the moment of inquiry.

This tracing system supplies the memory, and so makes any quick, intelligent and careful man qualified for the place.

The production-order clerk should be a mechanic, a machinist, and an old shop hand in the factory where he is to act as production-order clerk; it is absolutely essential that he should be perfectly familiar with the factory product.

The transfer clerk must have the same training and experience, he must be a machinist, and must be familiar with the powers and possibilities of the entire production plant, and of each workman as well, so that he can make the best selections in placing construction orders in regular course, and can place orders where they will be most quickly produced in emergencies.

In the Cottrell factory these positions of vital importance are filled by two of their own machinists, who are twin brothers, each employed for more than ten years as a workman before assuming official functions. Neither of these men had commercial training, and between them they keep the factory running very smoothly indeed, because the production-order and transfer systems leave their minds perfectly free, and reduce their duties to the mere prompt and careful following of the fixed routine.

A carefully kept card record could be made to hold all the information contained by the department trays and cards, but it

would be more costly, and probably as bulky, and certainly far less easily used than the "department tray" and tracer and forms-14 system.

There is a broad difference between visible things and written words, and non-literal records, made of visible and substantial things, are easier used than written records.

This Cottrell tracing is by visible things, not by words, hidden in books or card trays, and visibility is of the highest importance in factory stores and in component tracing.

It is not improper to say here that this Cottrell tracing is a conception of Mr. Charles P. Cottrell, and that it has been tried in a vast number of modifications in the Cottrell factory, where something of the sort is an imperative necessity, and has been persistently experimented with, and violently opposed in the factory, and has been brought to its present condition of simplicity and effectiveness through many errors and failures of the most discouraging character.

As first said, this production order and transfer system is believed to be in use in the Cottrell factory only. Probably, however, there are many existing approximations to this practice, although not generally known, and the method appears to be applicable to factory production at large, and to be of very great value.

Form 16A. Front. Machine-Shop Order. Stiff manila card, printed in black. Size, 2 7-16 inches long by 3 13-16 inches high.

Machine-shop order for rough components, either forgings or castings of any material; filled by transfer clerk from sub-production or S. K. component orders, and sent to the forge-and-foundry clerk, who sends proper trays of forging cards to the smithy for forgings.

Form 16A. Back. Date and "received by" space are both filled by the forge-and-foundry clerk.

For castings, the forge-and-foundry clerk fills forms 20B, white, with component symbol, number and material, brass or grey iron, and sends the substitute forms 20B to the foundry foreman, who examines them, and such as he finds made are noted by placing the forms 20B calling for them in a "made" receptacle in the foundry office. Then the foundry foreman pro-

cures the needed patterns and proceeds to make the remainder of the castings as called for on the substitute forms 20B. Forms 16A go finally to the cost clerk, and should be kept clean, and so are held by the forge-and-foundry-clerk in his office, as are forms 16A which call for forgings, in waiting trays, with the inscriptions to the front. The smith turns his cards in his trays as he completes the forgings, so that they stand with inscriptions to the rear. The foundryman places forms 20 in the "made"

Style	
Pat. Marked	
Name of Piece	
Material	
No. of Pieces	Weight

Date received in Shop	Received by
-----------------------	-------------

FORM 16 A. FRONT AND BACK. MACHINE-SHOP ORDER FOR CASTINGS AND FORGINGS.

receptacle when castings are done. When the material called for on forms 16A should be done, the forge-and-foundry clerk sends his laborer to the foundry, the laborer takes the "made" checks to the forge-and-foundry clerk, who then takes his forms 16A from the waiting tray, and weighs and counts the castings and marks the date and weight on forms 16A and sends them to the transfer clerk, filled back and front, signing his own name as receiver, on the back.

THE FORGE-AND-FOUNDRY CLERK.

The function of the forge-and-foundry clerk is to see that the castings and forgings ordered by principal orders and by sub-orders of all kinds, are sent to the machine shop as soon as may be after receipt of orders, and that they satisfy the orders

for numbers, and to make weight records on forms 16A, and copy those weights on the daily castings weight sheets, brass and iron, and to fill the monthly castings weight lists from the daily castings weight totals.

For the smithy, the forge-and-foundry clerk sees that the principal-order-forgings trays kept in his cabinet are correctly filled with green cards, form 20, inscribed with the list numbers and symbols of parts ordered on forms 16A, and to send these trays into the forge shop, and after forgings are made, to weigh and count them, and record weight and date on forms 16A which call for the forgings.

In case of minor-production, S. K. and repair orders for forgings, forms 16A are sent by the forge-and-foundry clerk directly

NOV. 20	SK	6591.
12 Sliders.		
5K-27.		
Form 17.		

FORM 17. S. K. TRACER.

to the smithy foreman, who returns them with the forgings to satisfy the forge-and-foundry clerk.

Forms 16A go to the transfer clerk when the forgings and castings they call for are sent into the machine shop, and are sent daily by the transfer clerk to the cost clerk, who charges the weights, and holds the forms 16A for a reasonable time.

The forge-and-foundry clerk fills an important position, and must be familiar with the factory product, and must be accurate in weights and records. The Cottrell factory has many thousands of patterns, some of them made many years ago, and not used for a long time, and these may be perplexing to the forge-and-foundry clerk, who has plenty to look after.

Form 17. The S. K. Tracer. Stiff white card, rubber hand-stamp "S. K." impression, in dark blue. Size, 2 7-16 inches long

by $1\frac{3}{8}$ inches high. Shown filled and dated. The full significance of form 17, as here reproduced is as follows: "Nov. 20, 1902. These 12 sliders are to be made immediately, and are not store-room replenishments, but are to be used in completing principal-production order 6591, and charged to that order. The symbol of the slider is 5K-27. See 5K blue-print details component 27. Deliver these 12 sliders to waiting-stores room when completed."

Form 17 is the S. K. "tracer," that is to say, it is the substitute for the component of the same order number, and has its number applied by the production-order clerk; the transfer clerk enters date on the back of form 17, and places it standing upright in any vacant groove of the tray representing the first operation department to which the casting or forging is sent when work begins on the component. Form 17 then stands for its component, and is dated on its back and transferred from one department to another when its component makes the change. The tracer finally goes from the transfer clerk to the cost clerk, with the S. K. production order of the same number.

Form 18. Cost Card. White stiff card. Ruled in blue and black, printed in black. Size, 4 15-16 inches long by 2 15-16 inches high.

Component cost summary, itemized. Filled by the cost-keeper. Weights are taken from form 21, which see, labor taken from time cards, and from forms 11, "Materials delivered;" totals are entered by the cost-keeper on "Cost statement," form 14A, bearing the order number. Finally filed, after principal order is completed, in cost-keeper's room.

Form 18 is a journal entry of all charges, including expense percentage, against a component of a principal-production order.

REPAIRS AND MINOR PRODUCTIONS.

The principal production, or regular output of the factory, no matter how varied its forms may be, can always be brought into some tolerably close approach to that strictly routine form which is the desire of the manager, because it is constantly in progress, and the efforts of all officials are continually directed towards regular production-process betterments. As time passes, and it is the flight of time alone which can bring approximation to perfection, obstacles are removed, rough places are smoothed

over, methods of handling work are improved, small but beneficial changes are made, objecting minor officials are gradually but surely forced into line by the steady pressure of the routine, and the whole system advances continually towards that unchanging regularity of action which the manager seeks to establish. All of this is highly beneficial. Absolute fidelity to routine is the condition sought, and as perfect routine is approached all the minor factory officials find their duties easier of performance, and so become intolerant of irregularities, as they should be.

But there is one irregularity which must be accepted and

Quantity	No. of Piece	Name of Piece									
Size and Kind		Labor									
Order No.	Date										
	Material										
Total Material											
Total Labor and Factory Expense											
Aggregate				Factory ex. @							
C. B. COTTRELL & SONS CO. COST CARD A											

FORM 18. COST-SUMMARY CARD.

promptly cared for, and that is the filling of customer's repair and replacement orders. These repairs are of vital importance to the users of the principal product, and if the good will of customers is to be gained and kept, as it must be if product sales increase is to be hoped for, then repair orders must be correctly and promptly filled, notwithstanding the undeniable fact that repairs production must always be irregular, and must always derange the factory routine which should never be disturbed or in any way crowded or infringed upon.

Because of these contradictory conditions, it is extremely difficult to handle repair orders in such a way that they shall fall

into the regular production routine without disturbance or confusion.

Repair orders may be filled from the storeroom, which keeps a large part of the most commonly ordered repairs in stock, but repairs must very often be new productions, and must always be shipped as quickly as possible.

The Cottrell repairs are handled by the use of forms 19, 19A, 19B and 19C, which constitute a highly ingenious combination, and merge the irregular and fluctuating repairs production into the principal-production routine without the slightest shock or disturbance, give full and instant information to all officials, and at the same time are extremely simple in themselves and call for but little clerical labor.

Form 19, 19A and 19B, filled in original, carbon duplicate and carbon triplicate, are wandering documents, similar in general scheme of performance to the triplicate purchase forms.

The functions and lodgements of forms 19, 19A and 19B, used in filling every repair order, are fully detailed, and can be readily comprehended; 19C is the tracing sheet, used only when the "R" order cannot be entirely satisfied from the storeroom.

Form 19. Repair Order. Yellow bond paper. Ruled in blue, red and black; printed in black. Size, $7\frac{7}{8}$ inches long by 3 15-16 inches high. Perforated at right hand end for binder. Original. Shown as filled by purchase agent's typewriter.

Form 19A. Yellow bond paper. Ruled in red and black; printed in black. Carbon duplicate of form 19, except price and extension, which on form 19 are outside of the area of form 19A. Size, $5\frac{7}{8}$ inches long by 3 15-16 inches high. Not engraved.

Form 19B. Front. Light card. Pale buff. Ruled in red and black; printed in black. Carbon triplicate of form 19. Size, $5\frac{7}{8}$ inches long by 3 15-16 inches high. Perforated at bottom. Not engraved.

Form 19B. Back. Order cost form. Ruled in red, blue and black; printed in black.

For a repairs order which can be completely satisfied from the storeroom, forms 19, 19A and 19B, front and back, are sufficient, and form 19C is not used.

Form 19, original, is filled by the purchase agent from instructions by mail. This example is an order received on the

New York office order form from customer's specifications. It is held by the purchase agent in his waiting tray until form 19A is returned, shipped, from the shipping clerk, with shipment date and route.

The purchase agent then adds prices and makes the extension and sends form 19 to the billing clerk. The route is added by the purchase agent when informed originally.

The billing clerk makes the bill from form 19, and then files the form by binding it. Forms 19 are numbered consecutively and when bound form the repairs journal.

[illegible]

FORM IQ B. BACK. REPAIR ORDER. TRIPLICATE.

The bill prices extension is entered on form 49, on the same line as "Costs." (See form 49.)

Form 19A, duplicate is filled with form 19, and sent to the machine shop superintendent, who punches 19A and sends it to the storekeeper, who satisfies form 19A so far as may be from stores.

If entirely satisfied by stores, form 19A goes with its satisfaction to the boxing room, is boxed, and the box is sent with form 19A to the shipping clerk, who fills in shipment date and

route, and returns form 19A to the purchase agent, who files it in his "Repair orders filled" cabinet drawer.


If 19A cannot be entirely satisfied by the storeroom, then the storekeeper sets aside such parts as he has, and marks the items he is unable to supply with letter "R" and sends form 19A to the production-order clerk, who makes sub-production orders to produce what is marked "R," using forms 12, 12A or 12B, according to department where lacking components are to be produced, and fills form 19C, minor-production-order tracing sheet, and sends the sub-production orders with 19C to the transfer clerk. Form 19C has precisely the same functions as form 14A, but is for small special orders having but few components, while 14A is for regular principal productions, having a great number of components. Form 19C is sent with the production orders to the transfer clerk, who at once places the required components in work, procuring his rough castings and forgings through the forge-and-foundry clerk as in case of principal-order production, and tracing the components through the departments by making date and section number entries on form 19C, wherever he best can. When the production-order clerk sends form 19C to the transfer clerk, he also returns form 19A to the storekeeper who lodges it in his "repairs" waiting file.

When the components traced on form 19C are made, the transfer clerk sends them with their production orders to the storekeeper, who adds them to his previously set aside partial satisfaction of the same order number, thus completing the satisfaction, and then takes form 19A from his repairs waiting file and sends it with the satisfying components to the boxing room as in the first case. The storekeeper then returns the satisfying production orders to the transfer clerk, who puts them with their tracing sheet, form 19C, and sends all to the cost clerk, who files form 19C for future reference.

Form 19B, triplicate, is filled by the purchase agent with form 19, and sent to the cost clerk, who fills back of 19B from time cards, and from forge-and-foundry weights and from materials delivered cards, form 11, as may be charged against the order number, and sends form 19B, back filled, to the commercial accountant, who enters cost totals on cost and sales sheet, form 49, on the same line as bill extension. (See form 49.)

Form 19C. Minor-order and repairs-order tracing sheet. Yellow paper; ruled in red, blue and black; printed in black. Size, $5\frac{7}{8}$ by 4 inches. Filled by the production-order clerk in manuscript from form 19A, to trace components marked "R." Sent with "R" sub-production orders to the tracing clerk, who holds it in his card-indexed forms 19C tracing tray, until the storekeeper returns the related production orders to the transfer clerk, who then bundles the sub-production orders with form 19C and sends them to the cost clerk, who files forms 19C.

Components are traced on form 19C by the transfer clerk,

Production Order No. <i>A 6037</i>		To Section No.		Date of Order <i>11-23-02</i>																						
Please execute the following order, returning the order on completion of the work to the office. Charge all labor and material to the above production order number.																										
Description of material to be used																										
Quantity	<i>3 Vibrator Gears, $\frac{5}{16}$ hole, 2 $\frac{1}{4}$ face.</i>																									
	<i>100 Fly Sticks, different lengths.</i>																									
Check space when article has passed through section	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	SK					
To be Completed Form 19 C	Date Completed				Approved																					
				C. B. COTTRELL & SONS CO.																						

FORM 19C. MINOR-ORDER AND REPAIRS-ORDER TRACING SHEET.

by date and section number notations made on the face of 19C as near the component description line as may be, no factory section spaces being provided in the form printing for more than one single component.

The numbered spaces in the "check space" line were intended to be used for tracing through the factory sections; this form 19C was originally intended to be used for principal-order components tracing, the scheme being to fill a form 19C for each single component.

This use of form 19C was found inconvenient because of the

Forms 20, 20A and 20B. Small stiff cards, 20 and 20A green, and 20B white. These cards are used in great numbers, and are supplied, blank, to the production-order clerk and the forge-and-foundry clerk, who alone have use for them in the regular course of affairs. The foundry foreman does sometimes fill one of these forms 20 in case of accidental description. These cards blanks are all one size, 2 7-16 inches long by 1 3/8 inches high, the same as the S. K. tracer, form 17, which see. Form 17 is merely a blank form 20B, filled with rubber stamp "S. K." and manuscript specifications by the production-order clerk.

As before said, the foundry foreman has in his office cabinets of principal-production, grooved card trays, each tray containing a card for each different casting in that particular press, as

UG	10 A
1	
Side Frame	
Form 20.	

FORM 20. TRACING CARD. "FOUNDRY CHECK" FORM.

follows: Each tray groove bears a component symbol, and if there is but one single piece of a kind, the groove holds but one card inscribed with the piece symbol, but if there is more than one piece bearing the groove symbol, that is, if there are repetitions of the same piece, then this piece symbol groove has as many cards in it as there are repetition pieces to be made. When the castings are to be made for a principal order, the foreman takes the pattern for a piece, and gives it to a molder with the one or more cards in the tray groove bearing the pattern mark or symbol; the molder then puts up one piece off the pattern for each card he has, and holds the cards, form 20, until he has a good casting for each card; then the molder takes the cards back to his foreman, who returns these "made" cards to their proper groove, turning their inscribed faces to the rear, and gives

the molder another card or cards, form 20, from the tray, with the pattern he is to mold next.

Forms 20, green, are originally filled by the production-order clerk during the first production of a principal order, and then do not require renewal until illegible from handling. Forms 20, after being filled by the production-order clerk, are sent by him directly to the foundry foreman, who produces the castings ordered immediately, and holds the latter, piled in the foundry yard, subject to the order of the forge-and-foundry clerk.

Where, as in the form 20 filling shown in the engraving, the principal order symbol, "U. G." in this case, is followed by a pattern symbol, "10A" in this example, "10A" is the pattern symbol of a pattern from another machine. If the pattern belonged exclusively to the U. G. order, then the pattern symbol would be U. G. 1, and the U. G. would not be followed by any pattern symbol.

Forms 20 are called "Foundry Checks," and are not used except as before specified by the production-order clerk.

Form 20A, green, is a "Smithy Check," filled by the forge-and-foundry clerk to satisfy any production order, and sent to the smithy foreman, who satisfies it with a forging.

In case of principal-order forgings, forms 20A are placed by the forge-and-foundry clerk in their proper grooves in the principal-order tray. In case of minor-production, S. K. or repair orders, forms 20A are sent by the forge-and-foundry clerk to the smithy foreman.

Form 20B is used by the production-order clerk to fill for S. K. tracers, form 17, which see, and for no other purpose. An S. K. order may call for any number of similar components, repetitions, and its tracer corresponds.

Consequently, because the foundry foreman, by his routine, gives the molder a white check for every single casting he is to make off a pattern when he gives the pattern out, he has not white checks enough if he wants more than one piece made off one pattern.

To meet this, the forge-and-foundry clerk upon receipt of forms 16A, made by the transfer clerk from the S. K. or other production order, proceeds to fill one form 20B with the order number and pattern symbol of each single casting called for, and

then sends these filled forms 20B to the foundry foreman, who is thus supplied with a white check, form 20B, for each separate casting he is to make, except in case of regular principal-order castings, which the foundry foreman makes from the principal production order on form 10, as before described.

In case of castings made on a principal order, the forge-and-foundry clerk fills forms 20 for each piece of castings required, and sends them by his laborer to the foundry foreman when the order is ordered in work, and obtains castings to satisfy forms 20. (See "Forge and Foundry Clerk.") Form 20B is shown in the engravings as filled by the forge-and-foundry clerk.

This description of forms 20, 20A and 20B could have been written in fewer words had these cards been given different colors for each different function. The cards are used without difficulty in the two colors of green and white, but a different color for each function would be preferable.

Form 21. Castings list for one principal-production order. White, bond paper. Ruled in blue and red; printed in black. Size, $10\frac{1}{4}$ inches long by $10\frac{1}{2}$ inches high. Some of the ruled portion of this form is omitted in the engraving.

Detail castings-production orders are made on forms 16A, and as many as 1900 castings-production orders are made for one single principal-production order. Form 21 is filled by the forge-and-foundry clerk, who sees the pieces weighed. It is sent to the cost clerk when castings are ordered in work. The weights and costs are transferred to the order cost card, and forms 21 are finally bound, and kept in the cost clerk's office.

TIME CARDS.

Forms 22 to 32, inclusive, are time cards.

Form 28. Light brown paper. Ruled and printed in black. Size, about 6 by 4 inches.

Forms 22, yellow, 23, pale blue, 24, salmon, 25, pink, 26, pale lilac, 27, pale yellow, 29, light pink, and 30, green, which are not engraved, are similar to form 28, except that they are for different shop sections and have different headings in the "Operations" column.

The time card scheme gives each workman a separate time card for each production-order number on which the workman

is employed during one day. In following out this plan a workman who performs short operations, as chucking or polishing, may have from 10 to 40 time cards for his one day's work. To avoid an excessive number of cards for one day of one workman's record, form 31 is issued. This form 31 is inscribed so as to be used only for operations of less than 15 minutes. In practice this limitation is not rigidly observed, form 31 being used for short operations, where the workman must charge his time to many different order numbers. Form 31 has 11 lines of record,

MAN NO.		SECTION NO. 8		DATE		190		OPERATIONS					
NAME						ORDER NUMBER		Lathe Work					
								Bench Work					
QUANTITY						DESCRIPTION OF WORK		Drilling					
								Boring					
								Sawing					
								Reaming					
								Splining					
								Bolt Cutting					
								Cam Milling					
								Surface Grinding					
OPERATION						HOURS		MIN.		Tapping			
										Polishing			
										Cutting Off			
6	$\frac{1}{2}$	7	$\frac{1}{2}$	8	$\frac{1}{2}$	9	$\frac{1}{2}$	10	$\frac{1}{2}$	11	$\frac{1}{2}$	12	
X	$\frac{1}{2}$	1	$\frac{1}{2}$	2	$\frac{1}{2}$	3	$\frac{1}{2}$	4	$\frac{1}{2}$	5	$\frac{1}{2}$	6	
										DAY			
TIME	PIECE	APPROVAL						HOURS	RATE	VALUE			
SERVICE CARD													

FORM 28. TIME CARD.

and so may serve instead of 11 separate cards, each bearing only a single order number charge.

Form 31. Light buff paper; ruled and printed in black. Size, about 6 by 4 inches.

The workman fills his time card or cards by making pencil crosses against the operation names and the time divisions. The workman must, however, write his order numbers, quantity, description of work, hours and minutes and his operation earnings at piece rates, noted in the extreme right hand space. The workman does not fill the "Rate" spaces. At night the workman turns his time cards into his foreman's desk, and the fore-

man is expected to carefully examine each time card, correct errors by consultation with the workman where needful, and finally to certify the correctness of the time card by a rubber-stamp impression of his name. This is done by the foreman the next morning after the cards are filled by the workman. The Cottrell shops are driven hard to meet orders, and run double shift more than half the time. After the time cards are vised and approved by the foreman they are transferred directly to the time clerk's office if the work is done by hour rate. If the work is done by piece rate, the time cards go from the foremen to

MAN NO.	SECTION NO.	USE THIS CARD ONLY FOR OPERATIONS LASTING LESS THAN 15 MINUTES IF DAY WORK.		SCREW MACHINE		TAPPING FORM		
				DRILLING	REAMING	31.		
		DATE	180	MILLING	POLISHING			
	NAME			PLANING	CENTERING			
				BUFFING	BORING			
ORDER NO.	QUANTITY	DESCRIPTION OF WORK			HRS.	MIN.	RATE	VALUE
TIME	PIECE	APPROVAL			TOTAL TIME		TOTAL VALUE	

FORM 31. TIME CARD FOR SHORT OPERATIONS.

the head of the construction department, called in this writing the machine-shop superintendent, department 21, (see Chart of Authority), where the department head fills the "Rate" spaces, and sees that the workman's own records of his piece-rate earnings are correct. From this department 21. the time cards go to the time clerk.

In the time clerk's department the cards are first sorted to men's numbers, all of each man's time cards being put together. Regular full time cards, day shift or night shift, have no "passed" mark given by the head of department 21. All over-time cards

are certified by the head of department 21, who punches them with a "T" conductor's punch. Over-time cards not so approved by department 21, are not recognized by the time clerk.

Each workman's time cards are assembled by use of the "Time card sorting box." This sorting box has a bottom, back, and two ends of pine board about 5-16 inch thick. The dimensions of the box are 16½ inches long, over all, 6 inches clear width, and 4 inches clear height inside. This box has a card wire at the back, 1½ inches below the top, and ¾ inch in front of the inside face of the back of the box, and this wire retains the top-tab numbered cards, 5-tab rows lengthwise of the vertically ranked cards. The cards are loosely held in standing position, each card bearing a single number, from 1 to 100 inclusive in the first division, 101 to 200 in second division, 201 to 300 in third division, and 301 to 400 in fourth division at extreme right. Each workman has an individual number which is placed by him on all of his time cards. When the time-card sorter begins to sort the day's cards, he places the top time card of the pile in front of the sorting box card bearing the same number, and so on, until all the time cards are placed in the box, each man's cards together. Then the time cards are taken out of the sorting box, the sorter examines the workman's time record on each, made by crossing in pencil the starting and stopping times, and places the time total of this labor charge in the total-time space of each time card, taking care, of course, to keep each man's cards together. The sorting box is long enough to hold 400 men's time cards besides the stiff tab-numbered cards which are held in the sorting box by the card-wire. This procedure brings each man's time cards together, and completes the time-card records.

The stacks of time cards are then taken over by the time clerk and paymaster, who examines each card to see that it is in correct form and properly approved, and adds the time items of each man's cards together, to obtain the man's total time for the day.

The time clerk then fills the "Scattergood" pay-roll form for the day of the current week from the time-card records, and the time cards then go to the cost clerk.

The cost clerk then proceeds to group the time cards by

their production-order numbers, and makes the order-number charges from the time-card records. The time cards are then filed away in papier-maché trays in the office vault, where they are kept for about six months, and then destroyed.

Form 32. Unproductive-labor time card. White paper; ruled and printed in black. Size, 6 by 4 inches.

MAN NO.		DEPARTMENT		DATE		190		EXPENSE Form 32					
NAME				ORDER NO.				Foreman,	Making,				
QUANTITY				DESCRIPTION OF WORK				Timekeeper,	Repairing,				
								Watchman,	Hardening,				
								Trucking,	Annealing,				
								Sweeping,	Dressing,				
								Oiling Mach'y,	Planing,				
								Cleaning,	Milling,				
								Engineer,	Welding,				
								Fireman,	Forging,				
								Clerical,	Packing,				
								OPERATION					
Gear Cutting,	Inspecting,												
								Crane Operat'g,					
6	$\frac{1}{2}$	7	$\frac{1}{2}$	8	$\frac{1}{2}$	9	$\frac{1}{2}$						
X	$\frac{1}{2}$	1	$\frac{1}{2}$	2	$\frac{1}{2}$	3	$\frac{1}{2}$	4	$\frac{1}{2}$	5	$\frac{1}{2}$	6	
TIME		PIECE		APPROVAL				HOURS		RATE		VALUE	

FORM 32. TIME CARD FOR UNPRODUCTIVE LABOR.

All of the time-cards are of the same dimensions, about 6 inches long by 4 inches high (10 by 15 centimeters), and are of thin paper, which is important, as the time card should take up as little room as possible.

COTTRELL CORRESPONDENCE.

All communications received at the Cottrell factory go to the general office manager, whose desk is in the department of plant, and are by him opened and examined, and made the subject of consultation with both superior and inferior officials as may be needful for fully advised action.

Form 33. Impression of rubber hand stamp applied to all correspondence by the general office manager. In sequence the blank heads are "Correspondence Number," "Account Number," "Date Received," (filled by stamp date), "Referred to," and "Answered." The engraving is full size.

Such communications as authorize a production order take impression of rubber-hand-stamp form 33A, and form 33B is applied to correspondence or to other papers as occasion demands.

All correspondence is finally filed in vertical letter files, by the correspondence clerk, who is responsible for the production of any filed paper when called for. The correspondence files are open, on application to the correspondence clerk, to examination by various officials, but no paper can be taken from the files by any one, without being replaced by form 70, "Correspondence Receipt," completely filled. See form 70, which is an indispensable feature of good correspondence filing.

Cor. No. _____
Acct. No. _____
DATE RECEIVED
NOV. 9 1902
REFERRED TO
ANSWERED
Form 33.

FORM 33. RUBBER STAMP FOR
CORRESPONDENCE.

Correspondence is indexed by cards, filled by the correspondence clerk upon filing of any paper or exhibit whatever, the same numbering appearing on all communications from any one correspondent in the "Correspondence No." space of form 33, which is filled by the correspondence clerk, who, in the Cot-is also the cashier, trell factory, By the vertical file system, letter sheets stand upright in a stiff manila paper folder, which has one high top edge, stamped with the correspondence number, and the

communication received and the reply thereto are filed in juxtaposition in the same folder. This admirable method of correspondence filing gives instantly any entire related correspondence, filed in order of dates.

The dictation by the purchase agent and chief accountant is to phonographs, of which two are used. The general office manager dictates to a stenographer.

Form 33A. Full size. Rubber stamp correspondence credit. Applied to correspondence serving as the basis for a production order by the head of department of plant.

Where a letter received is in such form as to permit service as the basis of a production order without literal change or addi-

tion, it may be stamped with form 33A, in addition to form 33, and when form 33A is filled by the head of department of plant with the credit rating of the correspondent, which may vary from "C. O. D." upward, these two rubber-stamp forms, 33 and 33A, convert the correspondent's communication into factory authority for production, and it may be sent to the production clerk with no added instructions; and under this authority the production clerk will proceed to make the production order, on the suitable form blank. The majority of these cases where the correspondence gives all advices to the production clerk are repair and replacement orders, requesting the immediate shipment of regular standard components of some of the regular Cottrell printing presses. When this is the case, the production clerk, by the system routine, should receive the letter authorized by the managerial and credit-stamp impressions, and proceed to requisition

<p>CREDIT APPROVED</p> <hr/> <p>ENTERED</p> <p>Form 33 A.</p>

FORM 33 A. RUBBER STAMP FOR
CORRESPONDENCE.

<p>NO CHARGE,</p> <p>Authorized by</p> <hr/> <p>Form 33 B.</p>
--

FORM 33 B. RUBBER STAMP FOR
CORRESPONDENCE.

the designated components from the storeroom. But, by the only circumflex observed in the whole operation of the Cottrell factory organization, these "Repair Orders," which use form 19, do not go through the hands of the production clerk at all, but are taken care of by the purchase agent, who has by long usage become perfectly familiar with the vast number of different components entering into the construction of the various Cottrell presses, and is, because of this familiarity, the best qualified official to see to the selection and forwarding of repair and replacement orders, for which form 19 is used.

All correspondence is stamped with form 33, and when so stamped the correspondent's advices are officially recognized, and the letter of advices then passes to the consideration of the head of the department of plant, who gives it full factory vital-

Form 34		Contract No.	Foundry No.	Finished No.	Date
Main Shaft	Speed	Press Pulleys	Motor		
Cone on Main Shaft					
Cone on Counter Shaft					
Driver on Counter Shaft					
To Run Impressions per Hour					
Distribution					
Delivery					
Molds		Rubber Blanket			
Stocks		Hard Packing			
Cast Rollers		Cutter			
Jogger		Counter			
Set Guides and Rests					
Back up					
Diameter of Air Chambers					
Stocks Sent to be Boxed					
To be Ready to Ship					
Built by					
C. B. COTTRELL & SONS CO.			Press Order Memorandum		

FORM 34. PRINCIPAL PRODUCTION ORDER SPECIFICATION.

ization by fixing the credit rating by the impression of rubber-stamp form 33A, with the rating written in.

Form 33B. Full size. Rubber hand stamp impression applied to correspondence serving as a production order, or to other documents as may be required. This "no charge" is authorized by the written signature or initials of general office manager, or of the head of the department of plant.

OUTSIDE WORK.

Form 34. Principal production order specification. White bond paper. Ruled in red, blue and black. Size, $7\frac{7}{8}$ inches long by 4 15-16 inches high.

<input type="radio"/>	Form 35 Front	C. B. COTTRELL & SONS CO.
	No. _____	Westerly, R. I., _____ 190__
	Mr. _____	
<input type="radio"/>	You will leave on _____ train _____ for _____	
	Route _____	

	Work to be done is as follows:	

<input type="radio"/>	_____	

<input type="radio"/>	IMPORTANT.	
	<i>Keep an accurate account of everything done on the job and make your report on the back of this sheet.</i>	

FORM 35. FRONT. OUTSIDE ERECTING FOREMAN'S INSTRUCTIONS.

This form notes all special features of driving, construction, operation and function. It also gives the contract number, and the foundry number, which is the production-order number, and the finished-product number, which is in numerical sequence of principal productions.

Form 34 is filled by the cost analysis clerk, from information given by the customer's order, and sent to the machine-shop superintendent, who vises it, and turns it over to the erection foreman, who has the job, who holds it until the shipment, and then returns all his forms 34 to the factory accountant, who

ager, by whom he is furnished with cash and the other forms which follow.

Form 35. Back. The outside erecting foreman carries form 35 with him, and fills the record spaces on the back, the space titles being such as to obtain a full history of labor and cash expenses and all dates of important occurrences. This form is returned to the general office manager on the completion of the job, vised and approved by the office manager and sent to the chief commercial accountant, who makes suitable bill if any charge is made. See space headings.

It is extremely important that the factory manager should be fully informed of the work of outside men on the factory product, either in original erection or in subsequent repairs of adjustments. These forms 35 are well adapted to the procurement of satisfactory performance and reports.

Form 36. Traveler's Expense Statement. White. Ruled in blue and red; printed in black. Size, 4 11-16 inches long by 6 $\frac{1}{8}$ inches high. Filled by the traveler, and sent to the general office manager.

Form 34 is not directly linked to forms 35, front and back, and form 36, but in case of an antecedent contract, having its specifications written on form 34, and the sending of an erecting foreman outside the factory to install this contract, forms 34, 35 and 36 can be used together as a means for enabling the outside man to record his entire performance, and return the full history of his work and a detailed account of his expenses to the factory manager, with great probability of obtaining the expected information.

Work done outside the factory walls is always highly important, and a full record should always be made. A most excellent mechanic may not be a good historian, and every possible aid should be given to the outside man, so that he may be enabled to tell the correct story of his outside trip.

Forms 34, 35 and 36, are the outcome of many different attempts looking to the obtaining of a full record of outside work, and can be used in any factory, the detail space inscriptions being varied, of course, to suit the factory product. The forms are small, concise and comprehensive, and, if not perfect models, are certainly most valuable suggestions.

Form 37. Weekly time card for workmen outside of factory. White bond paper. Ruled in red and blue; printed in black. Size, $8\frac{3}{8}$ inches long by $5\frac{1}{4}$ inches high.

Form 37 is filled by the workman, and in case there is more

[illegible]

FORM 37. WEEKLY TIME CARD FOR OUTSIDE WORKMEN.

than one man on the outside job, is certified by signature of the job foreman, and sent to the paymaster.

PLANT BETTERMENT.

Form 38. Blue bond paper. Ruled and printed in black. Size, 5 $\frac{7}{8}$ inches long by 3 $\frac{7}{8}$ inches high. Plant betterment order, used where cost does not exceed \$25.

Form 38 may be filled by any official, but must be vivified by the signature of the head of department of plant. All charges against orders made on forms 38 are recorded on proper blanks and time cards are charged to expense, and form 38 is sent to the chief accountant.

Form 39. White bond paper. Ruled in red and blue; printed in black. Serially numbered in red. Size, 5 $\frac{7}{8}$ inches long by 3 15-16 inches high. Perforated. Original of carbon duplicate filling on front of form 39A. Not engraved.

Form 39 is filled by the chief factory accountant only, and is vivified by the head of department of plant. This form is used for general factory purposes, being filled for plant betterments, costing over \$25, and for new sets of patterns for a new principal production, or for a new special machine tool. The original form 39 is sent to the head of the department where the order is to be executed, say to pattern-shop foreman or to machine-shop superintendent, but commonly first to the chief draftsman, who makes the needful drawings, charging them to the order number, and sending the drawings when done.

STANDING ORDER NO.	Issued by Department	Date
		190
To Department No. _____		
Please execute the following order and charge all labor and material to above Standing Order Number. _____ _____ _____ _____ _____ _____ _____ _____ _____ _____		
Form 38 SUB-PLANT ORDER.		

FORM 38. PLANT-BETTERMENT ORDER FOR SMALL AMOUNTS.

to the factory department where they are to be executed. (See form 39A, front and back.)

Form 39A. Front. White. Ruled in red and blue; printed in black. Size, 5 $\frac{7}{8}$ inches long by 3 15-16 inches high. Carbon duplicate of form 39. Serially numbered in red, same as form 39.

Form 39A, text carbon duplicate of form 39, goes to the cost clerk, and so informs him of the existence of the order; the back of form 39A has rulings and spaces for the order cost record.

Form 39A. Back. White, ruled in red, blue and black.
Cost card for order filled on original form 39.

In the Cottrell factory, patterns for new principal productions are given a factory-cost inventory value, but in case of changes in principal-production patterns, the change costs are charged to expense.

In case of repairs or casual or incidental pattern making, the patterns are charged to the order cost, and have no inventory value, though they are in all cases preserved, have a symbol given them, and are recorded on the pattern catalogue. This factory has an enormous number of patterns, perhaps 30,000 or 40,000, and the number is being constantly increased. The greater number of these patterns are obsolete and are not only of no value, but their storage is a cost. Patterns must be kept warm and dry, and require great storage room. Some factory managers endeavor to keep the number of patterns, and consequently the pattern storage room, as small as possible, by destroying all incidental, casual and repair patterns as soon as they have filled their original purpose. This course saves much, as a pattern not in use is, as before said, a continual charge.

The argument in favor of keeping all patterns is that the pattern has no salvage value, and can only be used for kindling wood if destroyed, and that since it was used once it may be called for again, and in case it is called for it is better to have it on hand than to have to wait to make a new pattern, and this view is accepted by many factories, including the Cottrell.

It is also the practice of some managers to charge all patterns directly to expense, and to carry no pattern values in the inventory. It is certainly much nearer the actualities to charge all pattern making to expense, than to carry all patterns as assets having a large inventory value, as it is only in rare cases that anything could be realized from a forced sale of patterns.

Form 39, 39A, front, and 39A, back, produce betterments and betterment cost records readily, and are small and give convenient reference information.

Forms 39 are returned to the chief factory accountant upon completion of order, and are filed by him.


EMPLOYEES' RECORDS.

Form 40. White, heavy paper. Printed in black. Size, 5 inches long by 2 15-16 inches high.

Employment and discharge record. Filled by the foreman of department where applicant is to be employed, who certifies his approval of applicant by his signature. Form 40 then goes to the Head, without whose signature no name goes on the pay

Form 40.	
Employment and Discharge Blank. Sect'n. No. _____	
Name _____	No. _____
Address _____	Rate _____
Age _____	Kind of Work _____
Date Employment Began _____	
Date Employment Ceased _____	Cause-Left-Laid off-Discharged. _____
Approved _____	Foreman. _____

FORM 40. EMPLOYMENT AND DISCHARGE RECORD.

Form 41	
CHANGE IN DAY RATE	
Section No. _____	
Name _____	No. _____
Change rate from _____	to _____
beginning _____	
Reason of change _____	
Approved _____	Supt.  Foreman _____

FORM 41. CHANGE IN DAY RATE OF WAGES.

roll, and then, signed by the Head, it goes to the paymaster and is filed by him.

Form 41. Yellow bond paper. Perforated. Ruled in blue;

printed in black. Size, 4 15-16 inches long by 2 15-16 inches high.

Change in day rate. This form is filled by department foreman, sent to the Head or to the head of department of plant, by him signed and then sent to the paymaster, who files it.

Form 42. Yellow bond paper. Printed all in black. Size, 4 $\frac{7}{8}$ inches long by 3 $\frac{7}{8}$ inches high.

Claim slip. Filled by workman who claims more than he has received. Vised by his foreman, and if passed by foreman, it is sent to the general office manager, and after adjustment, filed by him, in revolving cabinet in principal office.

Form 42.				Claim Slip.		Dept. _____	Sect. _____
Name _____				No. _____		Date _____	
My Envelope shows \$ _____ is due me for wages for week ending _____							
I think that I should receive _____							
and am therefore _____ short or overpaid.							
Hours Amount				Foreman			
Mon.				<p style="text-align: center; margin: 0;">NOTICE.</p> <p style="margin: 5px 0;">If you find there is any mistake made in wages due as per Envelope handed you, fill out this slip with your name and number and exact amount of wages on Envelope, also just the amount you think you should have received.</p> <p style="margin: 5px 0;">Hand this card to your foreman, who will present it to the Paymaster, who will investigate and adjust your claim.</p> <p style="margin: 5px 0;">Claim Slips received by 3 A. M. will be Adjusted and returned to foreman by noon of same day.</p> <p style="margin: 10px 0;">Adjustment _____</p>			
Tues.							
Wed.							
Thurs.							
Fri.							
Sat.							
Sun.							
<p style="margin: 0;">NOTE. If Claim is allowed the slip will be passed to the Office Manager.</p>				<p style="margin: 0;">PAYMASTER</p>			

FORM 42. CLAIM SLIP FOR ERRORS IN WAGES.

This form 42 has the effect of stimulating the paymaster, as he is required to record the particulars of the "adjustment" and must certify an error of his own, if he cannot place the fault elsewhere. Claims of payment error are annoying, and form 42 is a valuable preventive of payment mistakes.

PAY ROLLS.

Form 43. "Scattergood" permanent employment record and pay roll. White. Ruled in red and blue; printed in black. Perforated for binding. Size, 12 inches long by 17 $\frac{5}{8}$ inches

high. The original has 36 horizontal numbered lines, only 8 of which are shown in the engraving.

The general scheme of the "Scattergood" pay roll for both the workmen's and the salaried officials' roll, is to use one permanent roll for each class of employees, having the numbers and names of the employees, rate column, "employment began" column, "employment ceased" column, and "remarks" column. In connection with forms 40 and 41, the permanent rolls give the paymaster all information except as to piece-rate recompense, and hours worked.

Form 43A. Weekly pay roll. White. Ruled in red and blue; printed in black. Size, $7\frac{1}{2}$ inches long by $17\frac{5}{8}$ inches high. Perforated. The original has 36 numbered horizontal lines, only 4 of which are shown.

The weekly pay rolls are without the men's names, but keep the men's numbers. The sheet headings are: Amount paid, man's number, deductions, hours worked, amount by time, hours piece work, amount by piece, and seven columns for the seven days of the week. Perforations in the permanent and weekly pay rolls correspond, so that the weekly sheet can be placed over the permanent sheet, and thus make the men's names read into the weekly pay roll, though actually written only on the permanent roll.

Form 43B. Permanent salary roll and employment record. Ruled in red and blue; printed in black. Size, 8 inches long by 9 15-16 inches high. Perforated for binding. The original has 37 numbered horizontal lines.

Form 43C. Weekly salary roll. White. Ruled in red and blue; printed in black. Size, $4\frac{3}{4}$ inches long by 9 15-16 inches high. Perforated for binding. The original has 37 numbered horizontal lines.

The "Scattergood" pay and salary roll forms are very largely used, for the good reason that they reduce the labor of making up the pay roll to its lowest terms. The permanent pay roll need not be rewritten until it is worn out or becomes obsolete. The weekly pay rolls carry employees' numbers only, not the names, and demand only such manuscript entries as belong to the date week. In connection with form 43D and 43E, the "Scattergood" pay and salary rolls enable the paymaster to per-

Form 43 B.					
Salary Roll.					
THE SCATTERGOOD CO., PHILA., PA. Patented In U. S. In Canada. Oct. 13th, 1891. Dec. 13th, 1892.					
REFERENCE NO.	NAMES	Rate per Week	Date Emp. Began.	Date Emp. Ceased.	REMARKS
1					
2					
3					
4					
5					
6					○
7					
8					
9					
10					○
11					
Totals					
Sheet No. _____ From _____ to _____					

FORM 43B. "SCATTERGOOD" SALARY ROLL AND EMPLOYMENT RECORD.
The original has 37 numbered horizontal lines.

Form 43 C.

THE SCATTERGOOD CO., PHILA., PA.

Patented In U. S. In Canada.
Oct. 13th, 1891. Dec. 13th, 1892.

Reference No.	Week Ending		Week Ending		Week Ending		Week Ending		Week Ending		
1											
2											
3											
4											
5											
6											
7											○
8											
9											
10											
11											○
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											

Sheet No. _____ Month of _____

FORM 43C. "SCATTERGOOD" WEEKLY SALARY ROLL.
The original has 37 numbered horizontal lines.

three cents. The tallies are totaled and aggregated at the left, and there is a blank remarks-and-notation space at the right. The "page" column is the pay-roll page in the book of weekly-pay-roll sheets.

Form 43E. White bond paper. Printed in black. Size, $3\frac{5}{8}$ inches long by 6 $\frac{5}{16}$ inches high. Currency and specie list to meet pay roll exactly. Individual payments are analyzed, as for a payment of \$17.21, one \$10 bill, one \$5 bill, one \$2 bill, two dimes and one cent. The bank furnishes the money in the form specified. When the pay envelopes are filled, either shortage or surplus of funds shows error.

Form 43D and 43E are highly valuable aids to the paymaster, as they save time and ensure accuracy in disbursement. When the pay envelopes are filled and there is no money left, accuracy is assured. If there is anything left the "short" envelope can be quickly found.

Forms 43D and 43E are original with the Cottrell factory. It is not known that these forms are, or ever were, used elsewhere, although their utility is so obvious that probably they are used by others. These two forms make a perfect check on the pay envelope filling, and save time as well. They should always be used.

THE FOUNDRY.

No detail costs of foundry productions are made. All foundry supplies are in charge of the storeroom, under the immediate supervision of the receiving clerk. Foundry supplies are received by both water and rail. Manifest weights are accepted by the factory for water-borne consignments. Shipments by rail are weighed by the receiving clerk, and the rough stores, sand, pig iron and the like, are housed or piled in the yard as close to the cupola-charging stage as may be. The charging is by car, which is first run over the scales, and then on to a cable elevated platform. The brass is almost wholly one bronze, bought in pigs ready mixed and stored near the crucible furnaces on the foundry floor. Brushes, nails, and so on are kept in the foundry foreman's office. Facing is also actually in keeping of the foundry foreman. The day's cupola charge list is given to the melter by the foundry foreman, and this, and all other foun-

dry supplies used, are noted on forms 44 and 45, which are storeroom requisitions, signed by the foundry foreman, and sent every day to the receiving clerk, who sends them next morning to the cost clerk, who enters the totals of each item on weekly foundry statements, which are afterward aggregated on monthly foundry statements, and these monthly statements totals are transferred to a yearly foundry statement sheet bound in a binder, filed by the general office manager, and kept in a drawer of his desk. There is very little difference between the proce-

STOREKEEPER:					DATE			
PLEASE DELIVER TO FOUNDRY:				FOREMAN.		190		
QUANTITY	DESCRIPTION	PRICE	VALUE	QUANTITY	DESCRIPTION	PRICE	VALUE	
	Medium Molding Sand				Bolts			
	Coarse " "				"			
	Fine " "				"			
	Fire Sand				"			
	Fine Sand-Brass				"			
	Bank Sand				"			
	Clay				Washers			
	Egg Coal				"			
	Charcoal				"			
	Flour				Emery Stones			
	Vitriol							
	Sea Coal Facing				Hose			
	Wro't Iron Gaggers				Chisels			
DELIVERED				RECEIVED BY				
FORM 44				FOUNDRY MATERIAL DELIVERED CARD.				

FORM 44. REQUISITION FOR FOUNDRY MATERIAL.

dures of the Cottrell foundry and those of any other well-conducted foundry making a similar class of work.

Every good foundry foreman is and must be an "organizer" by instinct, and must also be able to deal promptly and wisely with the unexpected.

The nominal storeroom custody of all foundry supplies, merely brings the foundry foreman's own memorandum of what he consumes and puts out into regular lines of factory routine, by passing these memoranda to the receiving clerk in the form of requisitions on factory stores. See forms 44 and 45, which are filed by the cost clerk for a time, and then destroyed.

to the receiving clerk in the storeroom; sent by the latter to cost clerk, who enters items totals in the day line of the weekly foundry report. The weekly foundry reports items are totaled on the monthly report sheet, which is sent to the general office manager, who records totals on yearly sheet, having 12 vertical monthly columns, one for each month, as before stated.

Form 45. The same in every way as form 44, except different list of material items. Not shown.

Form 46. White bond paper. Red, black and blue ruling; printed in black. Weekly cupola-charging foundry report for large cupola. Size, $5\frac{7}{8}$ inches long by $3\frac{7}{8}$ inches high.

Filled by the cost-keeper from daily cupola-charge slips made by the foundry foreman and given to his cupola tender for daily cupola charge. Slips are sent to the cost-keeper daily. Forms 46 are held by the cost-keeper, the items totals transferred to the monthly report, and the forms finally filed by the cost-keeper for such time as may be thought sufficient.

Form 47. Pale yellow bond paper. Ruled and printed all in black. Size, 5 15-16 inches long by 3 15-16 inches high. Weekly foundry report for the brass furnace. Filled by the foundry foreman and sent to the cost clerk, the same as form 46.

ACCOUNTING FORMS.

Form 49. Heavy white paper. Perforated at top for binder. Ruled in blue and red; printed in black. Serial member at top right hand in red. Size, 19 inches long by 12 inches high.

Filled by the commercial accountant, bound in binder, and kept by him.

Form 50. Heavy white paper. Blue and red ruling; printed in black. Size, $13\frac{1}{4}$ inches by 9 13-16 inches.

Expense Statement. Filled by the cost-keeper, sent to the general office manager, and by him bound and kept in his office. The expense percentage is calculated from 50 records by the general office manager, who notifies the cost-keeper if change is needed.

Form 51. Press Sales Sheet. Blue bond paper. Black ruling and print. Size, $7\frac{7}{8}$ inches long by $6\frac{1}{2}$ inches high. Perforated for binding at left hand side. Original. Top horizontal line perforated.

Obviously a bill to be sent to a purchaser can be written in form for journal entry, but the bill should bear the firm name prominently, which is not of use on the journal entry form. Again, the journal form should register top and left with the bill form, for convenience of the typewriter. Hence form 51 is perforated, so as to be torn across after filling, and is bound to form the press sales book, or principal production sales journal, kept by the chief accountant.

[illegible]

FORM 51. PRESS SALES SHEET.

Form 51A. White bond paper, printed all in blue. Size, 8½ inches long by 7¼ inches high. Not shown.

Bill head. Filled in carbon duplicate, when form 51 is typewritten. Form 51A is used for principal orders only, form 51B being used for "Repairs," which includes everything not falling under the head of principal orders, that is, printing presses.

It is of the very first importance that duplicate records

left hand edge. Red and blue ruling, black printing. Size, $11\frac{7}{8}$ inches long by $7\frac{7}{8}$ inches high.

Daily balance sheet. This form is notable for inclusiveness, as it shows at the end of each day on one single sheet all important items of the business. The whole trend of modern accounting forms, both costing and commercial, is to make one sheet tell all that it can be made to tell of related matters, and to bring all records to the instant of inquiry. The information carried on one line of this balance sheet is commonly contained in several different books. It is certainly better to make the one line of entries as completely comprehensive as possible.

Form 54. White card. Perforated for card file. Red and black ruling; black printing. Size, $7\frac{7}{8}$ inches long by 4 15-16 inches high.

Filled by the general office manager from form 51, and from customer's contract, and filed in drawer of revolving cabinet in the principal office, occupied by the three chief officials. Form 54 contains always a full history of each principal production, all particulars of sale and payment.

TRAVELING SALESMAN'S REPORTS.

Form 55. Outside. White, printed all in black. Folder. Size, when folded, $6\frac{3}{4}$ inches by $3\frac{7}{8}$ inches.

Traveling salesman's weekly expense and sales report and route list.

Form 55. Inside. White. Ruled in red, purple and black; printed in black.

Form 55A. Heavy white sheet. Perforated at left for binding. Ruled in red and blue; printed in black. Size, $7\frac{7}{8}$ inches long by $9\frac{7}{8}$ inches high. Traveling salesman's yearly sales and expense statement.

PIECE-RATE CARDS.

Form 56. Terra cotta thin card, perforated for filing. Printed all in black. Size, 5 inches long by 2 15-16 inches high. Piece-rate card. Filled by foreman, approved by Head.

Form 56A. Terra cotta heavy card, perforated for filing. Printed all in black. Size, 5 inches long by 2 15-16 inches high.

Form 55 Outside.

TRAVELING SALESMAN'S
WEEKLY EXPENSE REPORT
AND ROUTE LIST.

SALESMAN _____

Route and addresses for next week, commencing

DATE _____	
MONDAY:	
CARE AT _____	
TUESDAY:	
CARE AT _____	
WEDNESDAY:	
CARE AT _____	
THURSDAY:	
CARE AT _____	
FRIDAY:	
CARE AT _____	
SATURDAY:	
CARE AT _____	
SUNDAY:	
CARE AT _____	

No. _____

SALESMAN _____

FOR WEEK ENDING _____

SALES FOR WEEK, \$ _____

INSTRUCTIONS TO SALESMEN.

This Sheet to be filled out complete up to Saturday night of each week and sent to the office by first mail.

The space between each heavy line represents a day's expense; the amount carried out to Total column to represent total daily expense.

Each column to be footed, total footings equaling footing to Total column.

As may readily be seen a strict compliance with the above will facilitate the office work very materially in several ways.

Do not fail to fill out Route and Address on back of this sheet before sending in.

Report by letter, without delay, any information or circumstances however slight, which may come to your notice tending to lower the credit of a customer from former standing.

C. B. COTTRELL & SONS CO.,
41 PARK ROW, N. Y. 279 DEARBORN ST., CHICAGO, ILL.
MANUFACTORY, WESTERLY, R. I.

Copyright, 1899, by E. P. Lord
Cleveland, Ohio.

No. _____
Month _____
Salesman _____
Days Traveled _____

DATE	FROM	TO	CASH FARE	EXCESS BAGGAGE	SLEEPER	CAR FARE	HOTEL	Telegra's	Sundries	TOTAL DAILY EXPENSE
SUN.										
MON.										
TUES.										
WED.										
THUR.										
FRI.										
SAT.										
TOTAL FOOTINGS										

Took out, or cash on hand at beginning of week, _____

Funds received for expenses during the week, _____

Date Received _____

Less cash paid for expenses for week as per above report, _____

Cash on hand at end of week, _____

Mileage on hand at beginning of week, (number of miles) _____

New mileage purchased during week, _____ on _____ R. R.

Book No. _____

Number of miles used during week, _____

Number of miles on hand at end of week, _____

FORM 55. INSIDE. TRAVELING SALESMAN'S WEEKLY EXPENSE REPORT AND ROUTE LIST.

Form 55 A.

Salesman. _____

		SALARY	TRAVELING EXPENSES	ENTERTAIN- MENT	OTHER EXPENSE	TOTAL EXPENSE	SALES	EXPENSE TO SALES
	JAN.							
	FEB.							
<input type="radio"/>	MAR.							
	1st Quar.							
<input type="radio"/>	APR.							
	MAY							
	JUNE							
	Half Year							
	JULY							
<input type="radio"/>	AUG.							
	SEPT.							
<input type="radio"/>	3d Quar.							
	OCT.							
	NOV.							
	DEC.							
	Totals							

FORM 55 A. TRAVELING SALESMAN'S YEARLY SALES AND EXPENSE STATEMENT.

card are filled by the cost clerk from regular shop performance time cards. Special effects, obtained by selecting workmen and putting the entire operation or piece construction on a special footing, are valuable only as records of extremes.

For piece-rate fixing an extended record of regular performances is of the highest value. Any notable production-rate fluctuation should, of course, be investigated with the greatest care. This card, when filled, is sent to the Head, for consideration.

SUB NO.	ARTICLE								Form 58.
NUMBER AND DATE OF PRODUCTION ORDER									
NUMBER OF PIECES MADE									
COST OF MATERIAL EACH									
COST OF LABOR EACH									
FACTORY EXPENSE EACH									
TOTAL COST EACH									
NOTED									
COST RECORD CARD									C. B. COTTRELL & SONS CO.

FORM 58. COST RECORD CARD.

Form 58. White stiff card. Ruled in red, blue and black; printed in black. Size, $5\frac{7}{8}$ inches long by $3\frac{7}{8}$ inches high.

Comparative component cost card. Record spaces for successive production costs. Filled by the cost-keeper. Used for special inquiry as to particular production rates.

There can be little doubt that much might be gained by filling this form constantly for all regular component production, and so showing successive lot and different workmen costs. Nothing short of continuous comparisons will give the true factory narrative.

Form 59

SECOND-HAND PRESS No. _____

WESTERLY, R. I., _____

We are to take the following Second-hand Press
from _____

Address _____

Name of Press _____

Number of Rollers _____

Bed Inside Bearers _____

Style of Press _____

Style of Distribution _____

Style of Delivery _____

Wire or Air Springs _____

Base or Not _____

Age and Condition _____

Can be taken out _____

Additional information regarding the above can be
had by communicating with _____
who made the deal.

C. B. COTTRELL & SONS CO.

PER. _____

MISCELLANEOUS FORMS.

Form 59. Yellow bond paper; printed all in black. Size, $5\frac{3}{8}$ inches long by $8\frac{1}{2}$ inches high.

Second-hand merchandise specification, sent to the factory by salesman, who takes second-hand press in part payment for a new one. Filled by the salesman, who announces by this form the conclusion of a matter thoroughly discussed beforehand.

Form 59A. Yellow bond paper, printed all in black. Size, $5\frac{1}{2}$ inches long by $8\frac{1}{2}$ inches high. Not shown.

Order notification, filled by the agent making the sale.

Both 59 and 59A are extremely useful forms. The taking of a second-hand machine and the reception of a new order, are both facts of importance to the factory, and the provision of a special form for each, ensures prompt communication of full particulars. Form items-space titles, once compiled and printed on the information blank, avoid inadvertent omissions, always likely to occur in case of original communications.

Form 60. Pale pink bond paper, printed all in black. Size, $4\frac{1}{4}$ inches long by $7\frac{7}{8}$ inches high.

Filled by the commercial accountant, sent to the shipping clerk, and by him destroyed after shipment is made.

Form 61. Flesh colored bond paper, printed all in black. Size, $8\frac{1}{4}$ inches long by $5\frac{3}{8}$ inches high.

Shipment notification. Filled by the commercial accountant, and mailed to consignee on day shipment is made. The consignee is also more fully notified by the duplicate of the railway bill of lading, see form 62, which is mailed later, as soon as the railway has taken the consignment. Form 61 is used for principal-order shipments only. Not shown.

Forms 62, 62A, 62B. Bond paper. Pale flesh color. Printed all in black. Size, 7 15-16 inches long by $10\frac{7}{8}$ inches high. Not shown.

Form 62, original, 62A, carbon duplicate, and 62B, carbon triplicate, are printed alike except as to the one word "Original" in reproduction, which reads "Duplicates" on the second sheet, and "Agent's Copy" on the third sheet.

Bill of lading for all railway shipments. Filled by the route agent, in the commercial accountant's room, in carbon triplicate.

The original is held by the factory, the agent's copy goes to the railway agent, and the duplicate is sent to the consignee, previously notified on form 61, as soon as the railway has taken the shipment in charge.

Form 60.	MARKS.									
	Date	For	Description	Con. No.	Serial No.	Weight	Shipment	Route	Car. No.	"

FORM 60. DIRECTIONS FOR SHIPPING CLERK.

Form 64.					
Shipped for					
Consigned to					
Description					
Routing					
Date	Serial No.	Boxes	Castings	Weight.	Marks
Remarks					

FORM 64. DOMESTIC SHIPMENT RECORD CARD.

Form 63. Pale flesh color bond paper, printed in black. Size, $7\frac{7}{8}$ inches long by $10\frac{7}{8}$ inches high.

Filled by commercial accountant and sent to forwarding

agent. Notification used for foreign shipments only. Not shown.

Form 64. White, heavy paper. Red and blue ruling; black printing. Perforated for filing. Size, $5\frac{7}{8}$ inches long by 3 15-16 inches high.

Domestic shipment record card. Filled by the commercial accountant in carbon duplicate, original filed by general office manager, duplicate sent to New York office. This form 64, white, gives the New York office all information as to every domestic shipment, and so enables the New York office to correctly reply to all inquiries. Filed in a card tray in the New York office.

Form 64. Blue. Foreign shipment record card. Same size and form as form 64, white. Inquiries as to foreign shipments are directed to the New York office, and are answered from information given by the filling of forms 64, blue. All particulars of route, vessel, and so on, are inscribed on forms 64, blue, which are filed in a card tray in the New York office. Not shown.

Form 65. White bond paper. Ruled in red, blue and black; printed in black. Perforated at left hand end for binding. Size, $7\frac{7}{8}$ inches long by 3 15-16 inches high. Original.

Returned goods. Filled first as to items, by the commercial accountant, with carbon duplicate on form 65A, which is sent to the receiving clerk. Form 65 is held until the receiving clerk reports the material in the storeroom in good condition. If not in good condition, the salvage value is determined.

When the value of return is fixed, then form 65 has its value spaces filled, thereby completing form 65, and the returning account is credited with the total. If an outside credit, notification is made on form 66, which see; 65 and 65A ensure the factory against loss on returned material, as no credit can be made until after the material is reported in the storeroom, and form 65 has been vised and approved by the general office manager. At the same time, in case of an outside credit, notification of receipt and amount of credit given can be made intelligently, and promptly.

Form 65A. White bond paper. Ruled in red, blue and

○	Form 67. Journal Voucher		Date		J. V. No.	
	Authority		Account	Ledger	Debit	Credit
		Debit				
○		Credit				
○						
○						

black; printed in black. Size, $5\frac{7}{8}$ inches long by 3 15-16 inches high. Perforated for filing. Not shown.

Carbon duplicate of form 65. Filled by the commercial accountant, and sent to the receiving clerk, who reports condition of returned materials after personal examination of them and the entry of items on the stores ledger cards. The return of form 65 to the commercial accountant informs him that the material itemized has been received, and is in the stores in good condition. If reported not in good condition, the salvage value is ascertained before return credit is made. Form 65 is held for a time after form 65A has been completely filled, and is then destroyed.

Form 66. Flesh colored bond paper. Ruled in red and blue; printed in purple. Size, 8 7-16 inches long by $6\frac{7}{8}$ inches high. Not shown.

Credit memorandum, filled by commercial accountant from form 65, which see, and sent to the outside returner of material.

Form 67. Heavy white paper. Ruled in red, blue and black; printed in black. Perforated at left end for binding. Size, $7\frac{7}{8}$ inches long by 4 15-16 inches high.

Filled by the commercial accountant from any advices or vouchers, but principally from factory records. Sent with voucher in case of letter or other voucher originating outside of the factory, to the general office manager for inspection and approval. This form is bound in a binder and kept by the commercial accountant.

Form 67 is the general journal form, and is used for all journal entries not recorded on journal forms specially adapted to the record.

Form 68. Statement. White bond paper. Blue and red ruling. Top line printed in red. Remaining text printed in blue. Size, 5 7-16 inches long by $8\frac{1}{2}$ inches high. Not shown.

Filled by general accountant. Sent to debtor.

Form 69. White heavy bond paper. Printed in blue. Size, $7\frac{7}{8}$ inches long by $10\frac{3}{8}$ inches high. Not shown.

Combined information request and reply form. Reply written on same sheet, and all returned to sender. This is a very convenient form, largely used.

Form 70.		To whom given	Cor. No.
Given out by		Date given	
<div>Items</div> <div>ENTIRE CORRESPONDENCE _____</div> <div>LETTERS RECEIVED _____</div> <div>LETTERS SENT _____</div>			
<div>Returned</div>			
CORRESPONDENCE RECEIPT			

Form 70. Correspondence Receipt. Bright yellow bond paper. Size, $7\frac{7}{8}$ inches long by 5 inches high.

Form 70, fully filled, must replace any letter or paper taken from the files in charge of the correspondence clerk, and when returned, the return certification is made on the lower part of form 70. It is often highly important to be able to trace the history of a paper after it has become part of the permanent factory records. Form 70 notes the abstraction and return of a paper, and is a necessary form, either this or an equivalent being indispensable to efficient correspondence filing.

Form 71.
<i>Name</i> _____
<i>Business</i> _____
<i>To See Mr.</i> _____

FORM 71. VISITOR'S CARD.

Form 71. White bond paper. Printed in black. Size, $3\frac{3}{4}$ inches long by $2\frac{1}{8}$ inches high.

Caller's slip. This is a very simple and easily filled form, and is effective without being offensive. Caller's slips often demand needless particulars of information.

RECORD FORMS.

The two following "Record" forms, A and B, have recently been put in use at the Cottrell works. These forms contain no material or labor spaces, and are used for purely historical records, and do not affect the costing in any way.

The records shown are under column headings of printing-press component names, but this form is capable of general application, and may be used for any production by making the column headings to suit the manufacture.

These forms A and B give full "Work in Progress Records," and are used to relieve the memory of the general manager from a part of its burdens, by tabulating on a foundry-record form which is the first of the two record forms used, the fact that the piece has been made and is held by the foundry ready for delivery to the machine shop, this record being made by the foundry foreman by a pencil cross at the left of the component column space, which is the simplest certification symbol known. Neither date nor weight are recorded because those records are on other forms, and it would be work thrown away to write them on this form which simply tells what components of an order in progress have been made in the foundry, and whether those pieces have been ordered into the machine shop or not.

The translation of the foundry record, form A, is as follows:

"Presses ordered in foundry, Jan. 3, 1903. 10—No. 3 K presses. The foundry numbers of these ten presses are 2,000—2,009, in sequence and inclusive, and the construction number against which all charges are written, is 2,000." Two numbers have events recorded in a single space, one above the other to save room. This does not confuse the record at all. Continuing the record translation, "The cylinders, sides right, sides left, bases, tracks, beds, tables, rocker shafts, fountains, sliders, feed brackets right, feed brackets left, are made as shown by the left hand pencil cross in each space. All of these castings have been ordered in work and sent into the machine shop, as shown by the right-hand pencil cross in each component space." So much for the information recorded by the symbols above the mid-line of column headings. This specified list of components does not include all the castings called for by the cryptogram "10—3 K—presses," but only the larger pieces. There are five lines of spaces below the second line of column headings, and each of these lines may be used for two number records, thus making 10 record spaces available, as in the upper field of spaces.

This second line of column headings begins with cylinders. There is a large amount of work on the press cylinder, and it may be wanted first in the machine shop, and if a cylinder belonging to an order not yet in work is sent alone into the machine shop, this unusual procedure should be noted on this historical record form. The foundry foreman has a production order for

PRESSES ORDERED IN FOUNDRY.										DATE <i>Jan. 3-09</i>			
<i>10-#3K Presses</i>													
Foun. No.	Const'n No.	Cylinder	Side R.	Side L.	Base.	Track.	Bed.	Table.	Rocker Shaft.	Fountain.	Sliders	Feed Table Brk. L.	Feed Table Brk. R.
2000		x	x	x	x	x	x	x	x	x	x	x	x
2001		x	x	x	x	x	x	x	x	x	x	x	x
2002	2000	x	x	x	x	x	x	x	x	x	x	x	x
2003		x	x	x	x	x	x	x	x	x	x	x	x
2004		x	x	x	x	x	x	x	x	x	x	x	x
2005		x	x	x	x	x	x	x	x	x	x	x	x
2006		x	x	x	x	x	x	x	x	x	x	x	x
2007		x	x	x	x	x	x	x	x	x	x	x	x
2008		x	x	x	x	x	x	x	x	x	x	x	x
2009		x	x	x	x	x	x	x	x	x	x	x	x
Cyl'r Cast.	Presses Cast.	Blue S.K.	Trans. Cards.	Cyl'r Shaft.		Fountain Doctor.		Brass Pipe.					
x	x	x	x	x		x		x					
												Made	x
Form A.												Ord. into Shop.	xx

FORM A. WORK-IN-PROGRESS RECORD.

this construction No. 2000, but has not yet put out any castings on that order. He is notified to produce the cylinder only, does so, certifies production by the left-hand pencil cross, and the production-order clerk orders the cylinder into the machine shop by adding the right-hand cross in the cylinder space of foundry number 2000, and also places two crosses in the cylinder space of the second row of column headings. Thus the cylinder may go to the finishers in advance of its usual sending, and in advance of all other components of the order number, without danger of duplication, as the foundry man is at once informed by his record card that the cylinder for No. 2000 was made and sent into the machine shop before he began on the remaining parts. "Presses cast" column records the finishing of all the castings for press 2000. "Blue S. K." is another addition to the Cottrell forms, and is made to meet the "Red line" list distinctions by changing the color of the S. K. card from green to blue. This assists the transfer clerk, who knows that a blue S. K. order must be sent to the "Components waiting" storeroom upon completion, and must not be sent to finished stores, because it has been produced as part of a certain construction number and must be reserved to go to the assembling floor with the other components of that number. Two pencil crosses are filled in the blue S. K. space by the production-order clerk, one when he makes the blue S. K. orders, which vary largely in number according to the form of press, but average about 50 blue S. K. cards for each press, and the other when the production-order clerk sends the blue S. K. cards to the transfer clerk, which puts the S. K. components in work. The "Cylinder shafts" are hammered, not rolled, and are special for each order, as are the "Doctors;" the "Brass pipe" for each order is also made a purchase, and not taken from stores, and consequently the production-order clerk, who is virtually the private secretary and recorder and historian of the Head or manager, should have a record of the purchase order made for this material, without having to look further than this record card form, which tells what castings are made, what of the larger castings are in work in the machine shop, what S. K. orders have been made and placed in work by sending them to the transfer clerk, and what the purchase agent has ordered in the way of special material.

PRESSES ORDERED INTO SHOP.						DATE <i>Jan 13 - 03</i>					
<i>10 - #3 K PresSES</i>											
Found. No.	Serial No.	Blue S.K.	Date.	Cyl.	Built by.	Store House.	Shipped.				
2000	1900	x x	<i>Jan 11</i>		<i>Boulton</i>		<i>Feb. 26</i>				
2001	1901	x x									
2002	1902	x x									
2003	1903	x x									
2004	1904	x x									
2005	1905	x x									
2006	1906	x x									
2007	1907	x x									
2008	1908	x x									
2009	1909	x x									
Form B.											

FORM B. WORK-IN-PROGRESS RECORD.

As before said, all of this information is recorded in other places, but not all in one place, hence the great value of this record form, and the peace of mind and tranquillity of effort which immediately followed the introduction of this record form A, which deals with castings, making of orders, and making of purchases for the order. When record form A is filled as shown, it certifies that the machine shop has all of the order materials in hand, and is at work producing all the order components.

Record form "B," filled as shown, decrees that 10 No. 3 K presses shall be built, the date of the order being Jan. 3, '03, bearing an order charge number 2000, and that these presses shall have serial sales numbers from 1900 to 1909, inclusive, and the form shows that the blue S. K. orders were made and sent to the transfer clerk Jan. 11, '03, and that the first one of these presses made on order 2000, and bearing the serial sales number 1900 was completed and shipped Feb. 26, '03.

The final dispositions of the remaining nine presses of the order will be recorded as events occur.

It is probably because this record form deals with events only, instead of with materials and labor, that its need should have been sorely felt for a long time before its conception and installation.

These forms are printed on stiff manila cards, 6 inches long by 4 inches high, ruled and printed all in black.

Record cards A are used and handled as follows: Two forms are filled in duplicate, first two top columns only, by the production-order clerk, and one is sent to the foundry foreman, who files it in his tray, and the other is filed by the production-order clerk in a box on his desk, ready for instant reference. Once in two days the production-order clerk goes to the foundry foreman's tray of record forms A, and makes his own duplicate agree with the castings-produced record kept by the foundry. The card making and purchase records are made by the production-order clerk.

Form B is filled and filed by the production-order clerk at his desk. When the foundryman has made all the castings for an order and they are checked as transferred to the machine shop, the foundryman's form A is destroyed, as the duplicate record is held at the production-order clerk's desk.

This record card cools and binds up more factory blisters than any other one kind of form previously met by the compiler of this book. Many attempts have been made to present part of the story recorded on these forms, with only partial success, and it is difficult to propose factory conditions under which this record card could fail to greatly facilitate production, and assure that tranquil frame of the managerial mind which is the first essential requirement of the successful factory.

In the preparation of this chapter the author begs to acknowledge the friendly offices of Messrs. Gunn and Richards, of New York, who have greatly assisted in bringing the Cottrell system to its present advanced stage of development.

CHAPTER VII.

THE POTTER AND JOHNSTON MACHINE COMPANY, PAWTUCKET, RHODE ISLAND.

Pawtucket was one of the first places in America to begin iron working, the forge of Joseph Jenks, Jr., at the Pawtucket Falls of the Blackstone River, being established before 1750, and this district has ever since remained one of the principal metal-working and machine-tool-building localities of the United States. Pawtucket joins the city of Providence on the northeast.

The Potter and Johnston factory, at present confining its product to a limited line of very highly organized machine tools, and employing about 120 men, was established in Pawtucket in 1898, and was reorganized and took the name of the Potter and Johnston Machine Company in 1901; its founders were James Charles Potter and John Johnston.

The thorough shop training of Messrs. Potter and Johnston in shops of high repute in both Scotland and America, and the fact that these two men put their own money into a business originated and managed by themselves, in which they obtained an immediate success, give all the details of their practice peculiar interest.

While it is undoubtedly true that a perfectly correct estimate of the demands of their prospective customers, coupled with very high ability as machine-tool designers, enabled this firm to make their very first production an attractive success, both mechanically and commercially, it is also true that the methods of factory management by them devised, selected and adopted, must have been good enough to avoid serious loss to themselves, and serious annoyance to their patrons. Consequently the Potter and Johnston forms are certain to be of great interest to many managers of new and growing concerns, not yet much above the 100-workmen point.

Because of this. all of the Potter and Johnston form blanks

are here reproduced and fully described, and all of the books kept are also described, so that their business means and methods are fully detailed and explained.

It should be noted that the whole system is now worked up to about the limit of the official powers under the present arrangement, and, although no one is really overtaxed, yet all are very capable and energetic workers, all are young and active, and no one has any idle time on his hands.

THE POTTER AND JOHNSTON PRODUCT.

The basis of the success of the Potter and Johnston machines is a full comprehension of the necessity for labor flat-cost reduction in machine construction. The shaper, which was their first output, makes its own measurements of cut-depths in thousandths of an inch, and is fitted with a really good down-tool feed. This shaper is a machine for general use, single-piece production, and is second to no machine tool of its class.

The Potter and Johnston turret lathes are of two styles, the double turret manufacturing lathe, which is a one-man machine, and the manufacturing automatic chucking machine, which is entirely automatic, with the exception of placing the piece in the chuck and removing it when finished. As the machine requires very little attention from the operator, one man can easily run from four to eight machines, according to the class of work being done, and in this way the labor cost of producing the work is greatly reduced.

THE POTTER AND JOHNSTON FACTORY.

The productive floor space is nearly square, abundantly lighted, from the sides and from above, perfectly heated, and equipped, as might be expected, with the best machine tools obtainable. The line shafting, running on roller bearings, is driven by five electric motors.

THE OFFICES.

The offices and drawing room and pattern shop occupy the second floor of the two-story part of the factory building; they are very conveniently arranged and proportioned.

OFFICIALS.

James C. Potter, president and general manager, the "Head."

John Johnston, treasurer, and in charge of the drawing room.

The leading draftsman.

The bookkeeper, who acts as cashier, purchase agent, commercial accountant, factory accountant and paymaster, making up the manuscript pay roll, and delivering the pay envelopes to the workmen.

The stenographer and typewriter, acting as correspondence clerk, who also makes repairs and minor productions orders on forms 13.

The forge-and-foundry clerk, who acts as receiving clerk, and as cost clerk, and totals the time recorded on forms 6, 7 and 14. The totals of forms 6 and 7 are transferred to the individual principal-order operation journals, a separate journal being kept for each principal production.

The form 14 totals belong to repairs and minor productions, and are not carried to the principal-order operation journals.

The bookkeeper, the stenographer and the forge-and-foundry clerk occupy the first and largest office room together.

The president and the treasurer have an office in common, in rear of the larger office, and closely adjacent to the drawing room. The pattern shop is next beyond the drawing room. All of these are on the second floor of the office building.

THE MACHINE SHOP.

There is no foundry, and the smithy and the pattern shop are treated as machine-shop departments, with no special forms whatever.

Each machine-shop department is in charge of a foreman. The departments are not in any way partitioned off or separated from each other. The machine tools are grouped according to their different kinds and functions, and certain of the tools and workmen are placed in charge of one foreman to constitute a shop department, as follows:

Pattern foreman.

Smithy foreman.

Toolmakers' foreman.

Turners' foreman.

Two assembling foremen.

Planing foreman.

Tool-room keeper.

Leading draftsman.

The laborers are under the orders of all foremen. The night watchman keeps the shop warm through the night, changes the time cards Thursday nights, makes his rounds of the detector-clock stations, and cleans the chips off the floor under and about the machine tools. The night watchman does not sweep the entire floor, but he does remove all chips, leaving the floors about the tools clean when the workmen start in the morning.

FORMS.

The costing and tracing blanks, like the organization, constitute a very compact and effective system, and, by the division of duties adopted, the bookkeeper, the stenographer and the cost clerk together perform both the outside and inside office work of the factory, obtain the costs from the small operation divisions, and distribute the charges in great detail. The lists are made to serve as principal production orders, and are filled by the cost clerk; repairs orders and minor production orders are in charge of the stenographer.

BOUND BOOKS.

Because of the very apparent effort to reduce unproductive labor to its lowest terms, in the costing and commercial departments as well as in the factory, brief mention and description is here made of all the important books used in this establishment:

Letter press invoice copybook.

Factory sales book. In this are made original entries of all factory sales. The page column headings, reading from the left are: "Date," "Order Number," this column being filled with the order number in black ink; the sales invoice numerical sequence number in red ink, both red and black entries for each line space being filled; "Machine No.," filled with the numerical sequence principal product number; a wide "Name" column in which the product name is written in full; "Ledger folio;" "Ma-

chinery" column, in which individual sales values are entered; and, finally, at extreme right, a "Repairs and Sundries" column, in which minor sales values, tools and repairs are entered. The "Sales book" pages are $10\frac{3}{4}$ inches long by $11\frac{7}{8}$ inches high.

Cash journal.

Sales ledger.

General ledger.

Pay roll.

And besides these books there is an operation day book, in which all operation costs are entered from forms 6 and 7, and from this operation day book the operation journals, special to each principal production, are filled.

The operation journals are bound books, filled by the cost clerk from the records of forms 6 and 7.

Six of these journals are kept, one each for entries of daily total operation cost on each of the six following principal productions of the Potter and Johnston Machine Company, viz.:

15-inch shaper, 24-inch shaper, manufacturing lathe, manufacturing automatic lathe, simplex automatic lathe and the lever chuck.

The totals of these journal entries against an order give the flat labor cost, either in operation totals, or in complete aggregate. When an order is completed, the cost clerk makes a statement in manuscript of the order costs, both operation and total, and submits it to the head, for examination and action.

The size of the operation-journal page is 6 inches long by $15\frac{1}{4}$ inches high.

THE POTTER AND JOHNSTON LIST AND TRACING SHEET.

Form 1. Castings list. White, printed all in black. Size, $8\frac{1}{2}$ inches long by $10\frac{7}{8}$ inches high. Castings list for principal productions, combined with department tracing spaces, and a "Remarks" column. Only 9 of the 24 horizontal lines are shown.

The left-hand column of the sheet is the drawing-sheet number, next comes the column of "Pattern Numbers" for castings and "Piece Numbers" for forgings; then the name of the piece, next the number of each piece required for one machine, followed by columns for pieces on hand finished, pieces on hand unfinished, total number of pieces wanted for the order in course of produc-

Form I		CASTINGS LISTS.												
SHEET NO.	PAT. NO.	NAME.	No. of Pieces per Mach.	Pieces on Hand Finished.	Pieces Wanted.	Blacksmith.	Planing.	Turning.	Milling.	Rack or Gear Cutter.	Drilling.	Boring.	Hardening.	Remarks.
1	K-2	Base,	1											
31	K-3	Turret Slide Block,	1											
	K-4													
25	K-5	Turret,	1											
34	K-6	Turret Slide,	1											
34	K-7	Turret Slide Straps,	2											
31	K-8	Turret Slide Gib,	1											
31	K-9	Turret Slide Rack,	1											

FORM I. CASTINGS LIST.
Only 9 of the 24 horizontal lines are shown.



tion, and the "Foundry" column in the castings list and the corresponding "Ordered" column in the forgings list, which are filled when castings and forgings are ordered; next to right are the operation or department columns, the sheet closing with "Remarks" spaces at the right, in which steel castings and bronze castings are named in the castings lists, and various specifications are given in relation to the forgings.

This is a principal-production order, list, and tracing sheet, and is filled by the forge-and-foundry clerk on orders from the Head, by simply marking the component line spaces with an "X" if the space heading demands no action, or with the number of pieces required where action is demanded. As shown, the "Bed" line reads, "No beds on hand finished; 10 beds on hand unfinished; finish 10 beds."

Form 1A, the forgings lists, the heading of which is reproduced, is similar in general to form 1, and is filled in the same manner by the forge-and-foundry clerk, who fills enough books of lists to keep one set of lists himself, and to give one set to each foreman in the factory. These lists are sent directly to the foremen by the forge-and-foundry clerk, who procures the needed material and delivers it to the foremen, who then begin work on the order, the workmen's time being recorded on form 6 by the foremen, charged to the production-order number. For remainder of routine see form 24, text, procedures being the same up to "Boxing."

On the Potter and Johnston lists castings and forgings take a symbol composed of a letter indicating the machine, followed by a number designating the integral or compound component, castings being numbered from 1 to 500, and forgings from 501 upward. The lists covers are the same in form and title, except the words "Castings" and "Forgings," the words "Castings List" and the wreath ornament being in red, while the "Forgings" title is all in black.

These lists are on white paper, printed all in black, and nine sheets are put together for the castings lists and eight sheets for the forgings lists, in heavy manila paper, with two wire staples at the top of the sheets, covered with a fold of blue paper glued on the top end, which forms the back of the thin flexible book of list sheets. The size of the book is 8½ inches long by

Form 1A

FORGINGS LISTS.

SHEET NO.		PIECE NO.		NAME		No. of Pieces per Mach.										Remarks.	
						On Hand Fin.											
						On Order.											
						Blacksmith.											
						Planing.											
						Turning.											
						Milling.											
						Rock or Gear Cutters.											
						Grinding.											
						Drilling.											
						Hardening.											
64	K-501	Spindle,	1	10	9	1											(Geared Head Mch.)
64	K-502	Spindle Thrust Collars,	2														(Geared Head Mch. Large)
64	K-503	Spindle Thrust Collar	1														(Geared Head Mch. Large)
64	K-504	Spindle Toothed Clutch Keys,	2														(Geared Head Mch.)
64	K-505	Spindle Feed Cone Key,	1														" " "
65	K-506	Spindle Fric. Ring Blk. Screw,	1														" " "
64	K-507	Spindle Friction Key,	1														" " "
64	K-508	Driving Cone Shaft	1														" " "

FORM 1A. FORGINGS LIST.
Only 8 of the 24 horizontal lines are shown.

11 $\frac{1}{8}$ inches high. Each sheet has 24 component lines, which gives a record space in each book for 216 castings or 192 forgings.

These are the numbers of sheets used in the list books for the more highly organized principal productions. The shaper does not require nearly so many record lines, as it has, comparatively, but few parts.

The cover is printed:

“Manufacturing Automatic
Chuckling and Turning Machine
Castings List

—with—

Lever Chuck, Geared Head, Cross Slide

—and—

Back Facing Attachments.



Potter and Johnston Machine Co.,
Pawtucket, R. I., U. S. A.”

“Castings List” and the wreath are in red, the remainder in black. The red color distinguishes the castings lists.

Form 2. Factory requisition on purchase agent. Original white. Ruled in red and blue; printed in black. Size 5 $\frac{1}{4}$ inches long by 7 $\frac{3}{4}$ inches high. Yellow carbon duplicate. Only 3 of the 21 horizontal lines are shown.

The white sheet is perforated at the top. This form is furnished in covered pads, with the white and yellow sheets alternating, and so bound that the white sheets can be torn out and the yellow sheets, carbon duplicate, remain substantially bound in the covers. This form is filled in carbon duplicate by the forge-and-foundry clerk, from the lists, to satisfy verbal principal production orders given by the general manager to the forge-and-foundry clerk.

Form 2 is used for making the factory requisition, original No. 1, on the purchase agent, who is the bookkeeper, and is filled from the lists by the forge-and-foundry clerk and sent to the general manager, who vivifies it with a rubber-stamp impression of his name. Form 2 is then sent to the purchase agent, who

transcribes it on the same pad, in carbon copy, and files the original No. 1 in his office. This transcription makes original No. 2, and carbon duplicate No. 2. Original No. 2 is sent to the vender. Carbon No. 2 is held by the purchase agent. By this routine, when the purchase order to the vender is mailed, the forge-and-foundry clerk has a carbon duplicate of the requisition which he made from the lists to satisfy the verbal principal production order of the Head. Original No. 1, vivified by the signature of the Head, is held by the purchase agent. The purchase agent also holds the carbon duplicate of the copy of original No. 1, made by himself.

Form 2			
POTTER & JOHNSTON CO.			
ORDER NO. _____			
M. _____			
SEND TO _____			
OF _____			
SHIP VIA _____			
TERMS _____			

FORM 2. FACTORY REQUISITION ON PURCHASE AGENT.

The original has 20 horizontal lines.

Materials received are checked by the forge-and-foundry clerk, who is also the receiving clerk, on form 3, materials received, signed by himself, and he sends forms 3 to the bookkeeper, who holds them and compares them with their correspondence invoices when received, and finding them to correspond, then enters the totals on the back of form 11, purchase voucher, numbered in sequence, all the invoices of one vender for one month being attached to one of these folding vouchers, forms 11, with a brass fastener. The month's invoice amounts are totaled on the front of form 11, and certified by the bookkeeper in the "Correct"

space on the back; form 11 is then sent to the Head, who fills the "Approved" space with his signature, which authorizes the drawing of a check to satisfy, which is presented to the treasurer for signature. Form 11 is then mailed with the attached invoice and the check to the vender, who signs the receipt, (see form 11, back), and returns the invoice and form 11 to the factory. The bookkeeper, from the check stub, enters the payment against its proper "classification" or "standing order" on the front of form 11, dividing the amount as may be. This completes the purchase.

Form 3
POTTER & JOHNSTON MACHINE CO.
The following goods have been received:
Date, _____ 190
From _____
Checked by _____

FORM 3. CERTIFICATION FOR MATERIALS RECEIVED.

Form 3. Materials received certification. Pale blue. Printed all in dark blue. Size, $5\frac{3}{8}$ inches long by $4\frac{1}{8}$ inches high.

This is filled and signed by the cost clerk, who acts as receiving clerk also, and is then sent to the bookkeeper, who checks the related invoice from form or forms 3, and then sends forms 3 with invoice to the Head; after approval of invoice by the Head, the invoice goes to the bookkeeper with form 3, which is by him destroyed.

WORKMEN AND PAY ROLL.

This establishment maintains no definite relations with workmen, save that of wage-payer; 58½ hours, with no lost time, is paid as 60 hours, the 1½ hours being a "bonus" for steady attendance. There is no employment and discharge form, and no record is kept by the bookkeeper and paymaster of the workmen's residences. There are about 125 men employed.

The pay roll is written in full every week in a large bound book, lettered "Pay Roll."

Workmen's entering and leaving time is printed on form 4 by a time recorder, each man on entering the factory taking his own time card from the rack on one side of the recording clock, printing his time record on it, and placing his card in the rack on the other side of the clock. At the next shop entrance the operation is the same, except that the workmen pass the clock in the reverse direction. Starting time is 6:40 A. M. If a workman wishes to leave in working hours he must report to his foreman, and obtain a "coat-room order," although the coat-room is not locked. Having his "coat" order, the workman may then print and transfer his time card and leave the shop. The work week ends Thursday night, and pay day is on Saturday.

Thursday night the watchman takes the time cards from the rack and carries them into the bookkeeper, who totals the clock-recorded time, and writes the pay roll, and fills and delivers the pay envelopes on Saturday, after the week-end, at 12:40 P. M. The pay envelope is not printed. The workman's name and number are both type-written on pay envelopes by the stenographer. Thus the workmen's names are written twice each week, once by the paymaster on the pay roll, and once by the stenographer on the pay envelopes.

Form 4. Pay roll time card. Front. Stiff manila card. Printed in red; number in black; workman's name in manuscript. Size, 2 11-16 inches by 7 inches.

Forms 4 are furnished by the time recorder company, printed with numbers, 1 to 125; the workmen's names are written by the paymaster on each card.

Form 4A, back of form 4. Printed all in black. The head-

Form 4

This Side Out.

No. 115
NAME.

John Smith

Form 4A

Week ending _____ 190

No.
Name

DAY	IN	LOST OR OVERTIME		OUT	
		OUT	IN		
M	A. M.				
	P. M.				
T	A. M.				
	P. M.				
W	A. M.				
	P. M.				
T	A. M.				
	P. M.				
F	A. M.				
	P. M.				
S	A. M.				
	P. M.				
S	A. M.				
	P. M.				

Total time, _____ hrs.

Rate _____

Total wages for week, \$ _____

Form 5				
Name of Machine _____				
patt.		sheet		
Lot No. _____		No. of Pieces _____		
	OPERATIONS.	FIN.	PCS.	REMARKS.
	Turning			
	Planing			
	Boring			
	Drilling			
	Scraping			
	Fitting			
	Gear Cutting			
	Grinding			
	Assembling			
	Splining			
	Polishing			
	Painting			
	Chucking			
	Graduating			
	Blacksmith			
	Milling			

FORM 5. PRODUCTION ORDER AND TRACING SHEET FOR COMPONENTS.

ing is filled with a rubber dating stamp, number and name filling being omitted. The mechanism of the clock is such that by standing the card vertically in a slot in front and manipulating a lever, the workman prints the clock-changed minute-and-hour date in the proper day spaces of form 4A, the card-guiding-and-supporting gauges being shifted to locate the time stamp impression in its proper place. Fresh cards are placed in the rack every Thursday night by the watchman, ready for Friday morning's beginning of the new week's record. The total time, the rate and the amount are filled in by the paymaster.

Form 5. Individual principal-order-component production order and tracing sheet. Stiff manila card. Printed in black: "patt" and "sheet" in purple ink, rubber stamp impression. Size, $3\frac{3}{4}$ inches long by $6\frac{3}{4}$ inches high.

Filled by cost clerk with component symbol and blue-print-sheet number, lot number and number of pieces, and sent to the foreman of the first operation department with rough stores to satisfy. Form 5 accompanies each and every individual principal-order job so long as it is in work.

Form 5 is not used with repairs or minor production orders. It is sent to the forge-and-foundry clerk with completed work, and by him destroyed.

Form 6. Workman's time record. Stiff manila card, printed all in black. Size, $6\frac{1}{2}$ inches long by 6 I-16 inches high.

In the original there are four more blank horizontal lines, not shown in the engraving.

Workman's operation time record at day rates, used for any principal-order-component production. Headings are filled by the cost clerk; form 6 is sent by the cost clerk to the department foreman, who gives it, with the required material, to the workman, and notes the starting time. When the operation or component is finished, the workman takes form 6 to the foreman, who notes the completion time, and thus obtains the total operation time with workman's number, which gives the bookkeeper the operation cost, as forms 6 go to him from the foreman.

From forms 6 the operation cost is transferred by the cost clerk to a bound book, the daily operation journal, and the entries of this book are transcribed in special journals, one book journal for each principal product, to which form 6 is related. The entries

Form 6

DAY WORK, <input type="checkbox"/>		PIECE WORK, <input checked="" type="checkbox"/>		Workman's Name,		And No.	
Operation,				Date,			
	Lot No,	MON.	TUES.	WED.	THURS. FRIDAY	SAT.	TOTAL.
15-inch Shaper	38-90	1					
24-inch Shaper							
Manufacturing Lathe	31	2					
Mfg. Automatic	27	4					
Simplex Automatic							
Tools (New)							
Tools (Repairs)							
Equipment							
Lever Chuck							

FORM 6. WORKMAN'S TIME RECORD AT DAY RATES.
The original has 6 horizontal blank lines.

in each "separate operation journal" show the total day labor costs on each principal production, and also show successive lot costs for the same operation.

These individual principal-order-operation journal totals are very carefully examined by the Head, and compared with past similar records, and if not satisfactory, are made the subject of searching inquiry.

Form 6 and the individual principal product journals, have precisely the same functions as forms 7 and 19. Form 6 and the book journals record the operation costs of successive principal-order-component productions, performed at day rates.

Forms 7 and 19 gather the same costs where the work is done at piece rates.

DAY WORK AND PIECE WORK.

Only a very small proportion of the Potter and Johnston work is done at piece rates, hence the small piece-rate record surfaces of forms 7 and 19. It is the intention to use piece rates to a much greater extent than now, and it is also the intention to carry the smaller components of the principal production in stock, in a fully organized storeroom.

Returning to forms 6 and 7, and the operation journal and form 19, it may be said that they divide factory operations into small areas, and so invite close comparisons.

Form 7. Workman's time record at piece rates. Stiff manila card. Printed in black, except factory department title, which is in red. Size, $5\frac{7}{8}$ inches long by 4 inches high.

Workman's operation time record at piece rates, on principal order components. Headings and starting time are filled by foreman, who then gives form 7, with material, to the workman; upon completion, the workman returns form 7 to his foreman, who records completion time, and sends form 7 to the bookkeeper, who has the piece-rate costs in charge, and fills forms 19 with aggregates from forms 7, which are finally filed by the bookkeeper. (See form 19.)

Form 7, back. Instructions to workmen as to use of form, printed in black, as follows:

"Insert X in square opposite name of machine, tools, or equipment; and if piece or day work. Also fill in name of operation

Form 7

WORKMAN'S
NAME

WORKMAN'S
NO.

TURNING DEPT.		FOREMAN	
<div></div>		<div>PIECE WORK,</div> <div></div>	
NAME OF PIECE.		NUMBER OF PIECES.	
OPERATION		LOT	
Rate Per		Total Cost	
15-Inch Shaper		DATE	
24-Inch Shaper		COM. FIN. TOTAL.	
Manufacturing Lathe		Mon.	
Manuf'g Automatic		Tues.	
Simplex Automatic		Wed.	
Tools (New)		Thurs.	
Tools (Repairs)		Friday.	
Equipment		Sat.	
Lever Chuck			

FORM 7. FRONT. WORKMAN'S TIME RECORD AT PIECE RATES.

and number of pieces in lot going through. Mark the dates opposite days and the number of hours worked.

Form 8	
POTTER & JOHNSTON MACHINE CO.	
Travelling Expense Memorandum,	
Date _____ 190__	
R. R. Fare from _____ to _____	
" " _____ to _____	
Sleeper " _____ to _____	
" " _____ to _____	
Breakfast at _____	
Dinner at _____	
Supper at _____	
Hotel at _____	
Mileage Book—Miles Used _____	

Cash received from Potter & Johnston Machine Co. _____	

FORM 8. TRAVELING EXPENSE MEMORANDUM.

"Keep clean as possible and deliver to office when each operation is completed.

"Give a separate card for each job."

Form 8. Leaf of pad supplied to traveling employees. Filled by employee, and by him given or sent to the bookkeeper, who charges totals to the proper account, and fills form 20 from form 8, fastens the two forms together, and files them for future reference, in monthly envelopes; they are examined and approved by the Head.

Form 9. Letter-press copying book, in which forms 26 are copied, those forms being printed and filled in copying ink. Not shown. (See form 26, text.)

PURCHASE ROUTINE.

Form 10 is a list of the bound books used in the office, which have already been described.

Form 11. Front. Purchase Voucher. White, printed all in black. Size, 7 7-16 inches long by 8 13-16 inches high. Folding purchase voucher applied to all invoices, and permanently fastened thereto with brass fasteners by the bookkeeper. (See form 2, text.)

The purchase voucher, form 11, is folded in the middle up and down, and fastened to every invoice when received, and remains permanently attached thereto. Unpaid invoices are filed in a waiting tray serially, in order of their "voucher" numbers, all invoices of one vender being folded and fastened inside of one folded form 11, which bears the "standing order" list on the back, checked to show the account to which invoices are charged, in the "classification" list of titles.

The voucher purchase includes all standing-order purchases. These purchases are all entered in a bound book, which opens flat, one double page being used for the voucher purchase records of each month. The size of the double page is 34 inches long by 17 inches high. The heading is "Month of —, 190—." The vertical column headings, reading from the left, are first "line numbers," this left-hand vertical column being filled with printed numbers from 1 to 45, with a footings line next below, and a ledger-page index line at the extreme foot of the double page. The second column heading is "advertising." Then follow "telegraph and telephone," "general expense," "stationery, printing and office expense," "cartage," "water and light,"

Form II
Front

Voucher No. _____

POTTER & JOHNSTON MACHINE CO.

Name _____

Date _____ 190

\$ _____

CLASSIFICATION.

Castings, Steel . . .			
.. Iron . . .			
.. Bronze . . .			
Forgings . . .			
Steel and Iron . . .			
Miscellaneous Material			
Mdse, Purchases . .			
Repairs to Buildings .			
.. .. Machinery . .			
Tools and Supplies .			
Pattern Material . .			
Drawing Material . .			
Lumber			
Lubricating Oil . . .			
Power			
Fuel			
Water and Light . . .			
Carried forward . .			

Brought forward . .			
Cartage			
Taxes			
Insurance			
Management			
Office Salaries . . .			
Station'y, Pt'g & Office Expense			
Telegraph and Telephone			
General Expense . .			
Legal Expense . . .			
Patent Expense . . .			
Salesmen's Salaries .			
Commissions			
Traveling Expense . .			
Advertising			
Erecting Expense . .			
Permanent Equipment .			
Machinery			
Office Furniture & Fixtures			
New Construction . .			
Freights acc. Salee . .			

[illegible]

"fuel," "power," "lubricating oil," "lumber," "drawing material," "pattern material," "tools and supplies," "repairs to machinery," "repairs to buildings," "permanent equipment," "machinery," "new construction," "mdse. purchase," "miscellaneous." Then, under the head of "materials," "steel and iron, forgings," followed by a "weight" column; next, under the head of "castings," "bronze, iron and steel columns," followed again by a "weight" column; then, under a "sundries" head are three columns of "amount," "ledger folio" and "account." Next comes a wide column of "names," then a date column headed "when paid," next, "date of invoice," "ledger folio," then "audited vouchers" and finally, at extreme right, under a "voucher numbers" heading, a column of line numbers, with a space filled in red ink by "voucher numbers."

(See the "Cottrell" purchase routine.)

Form II. Back. Ruled in blue and red, printed in black. Form II, back, is filled by the bookkeeper each month, from one vender's invoice or invoices, form II being folded vertically in the middle, applied as a folder to contain the one vender's month's invoices, which are fastened to the upper left-hand corner of form II with a brass fastener. Form II, with invoices attached, is mailed to the vender with check to satisfy; the vender fills and signs the receipt form at the bottom as per Potter and Johnston instructions at the left, and returns the whole except the check to the sender.

See the "Cottrell" purchase routine, in which once writing the vender's order for material in carbon triplicate is made to give all factory notifications of purchase, advise vender to ship material as per order, and to finally form the journal entry of the purchase in a binder-bound journal. By use of the "check register" sheet, writing the check stub is avoided, and no purchase paper, except letter of advices to the vender and its satisfying check, leaves the purchaser, and no papers are fastened together.

The Potter and Johnston purchase routine demands two originals, one a copy of the other, two carbon duplicates, and the writing of the distributed purchase in the voucher-purchase record book, whose pages are 34 inches long by 17 inches high. The Potter and Johnston purchase also involves the sending of its

own original business records through the mail, and the signing of a receipt by the vender, and its return by the vender to the purchaser, Potter and Johnston.

When returned by mail from the vender, forms 11, with invoices and payment receipts attached, are filed by the bookkeeper in his "invoices-paid" file, and constitute a complete history of the purchase, in sequence of form 11 serial numbering, and taken in connection with the monthly voucher record sheets, furnish a detailed ready reference, in case of questions regarding the materials costs of any product.

Form 12. Voucher record book. Bound book, opens flat. Size of double page, 34 inches long by 17 inches high. See form 11, text, for description of this page, and list of columns heads

Form 13	
POTTER & JOHNSTON MACHINE CO.	
ORDER FOR SHOP.	No. _____
FOR _____	
Delivery promised _____	

FORM 13. SHOP ORDER FOR MINOR PRODUCTIONS.
The original is much longer.

and sub-heads, which are not reproduced in the form engravings. (See also description of Cottrell purchase routine.)

Form 13. Order for Shop. Light blue paper; printed all in black. Size, 7¼ inches long by 10⅜ inches high. Only the heading of this form is shown.

Filled in carbon duplicate by the stenographer from correspondence orders. The original is held on file in the office. In case of production not requiring the use of blue prints, the duplicate form 13 is fastened to form 14, and goes into the factory as detailed hereafter.

Form 13 is a repairs-and-minor-product-production-order form, called "express orders" in this factory. It is filled in duplicate by the stenographer and typewriter, under instructions from

the Head, acting, usually, on correspondence requirements, the stenographer referring to correspondence and the lists for detailed information. When filled, form 13 goes to the Head for approval and rubber-stamp vivification, and, these received, the order is then in work, and form 13, duplicate, goes to the forge-and-foundry clerk, who sees that the needed material goes into the first operation department, where the material is given to the foreman with form 13.

Before delivery to the department foreman, form 14, repairs cost card, shown partly filled, is fastened to form 13 with a brass fastener in upper left-hand corner. These two forms, 13 and 14, remain together, and go with the material through the various factory departments to completion, the "Hours" column of form 14 being filled by the department foreman. When the job is done it goes to the inspector, who inspects the work, passes it, and fills out his "memorandum" forms 15, 15A and 15B, in manuscript carbon triplicate, files the white original form 15 himself in his own file, and sends forms 13, 14, 15A, duplicate of 15, and 15B, triplicate, with the completed job to the boxer, who boxes the work and sends the four forms to the forge-and-foundry clerk, who totals the time and material charges, separately, on form 14, which he then sends to the bookkeeper, who examines the item totals, totals the charges, and then sends forms 13 and 14 to the treasurer, who examines the filled form 14 and approves it with his written signature, and fixes the amount of charge to the customer, and then returns forms 13 and 14 to the bookkeeper, who makes out the bill. Forms 13 and 14, fastened together, then go to the cost-keeper who files them for future reference.

In case the order specified on form 13 requires drawings, the duplicate is sent by the stenographer, after approval by the Head, to the leading draftsman, who procures the proper blue print, and secures forms 13, duplicate, and 14 to the blue print with a spring clip, and sends the three to the forge-and-foundry clerk, who then proceeds as in the first instance, the blue print, duplicate form 13 and form 14 going through the shops together. In case the blue print is used, it is separated from forms 13 and 14 after the job has been boxed, by the forge-and-foundry clerk, who sends the blue print to the drawing room, fastens form 13 and

its related form 14 together, and disposes of them as in the first case.

Form 13, original, is held permanently by the stenographer, as a record of his own performance, and as the office record of the factory production order.

Form 14. Repairs and minor-production order. Stiff manila card. Printed all in black. Serially numbered in upper right-hand corner. Size, 7 inches long by $8\frac{1}{2}$ inches high. Sixteen blank horizontal lines are omitted in the engraving.

Filled by forge-and-foundry clerk from instructions as per form 13, and attached to form 13, duplicate, with a brass fastener in the upper left-hand corner; forms 13 and 14 then remain together. (See form 13, text.) The "material" record is made by the forge-and-foundry clerk, and the labor-hours record is made by the foreman of the department in which the work is done.

Form 14 may also be spring-clipped to a blue print and form 13 duplicate. (See form 13, text.) It is filed by the forge-and-foundry clerk. (See form 13, text.)

Form 15. Inspector's Memorandum. White. Printed in black, both head and text guide lines. Size, $5\frac{7}{8}$ inches long by $8\frac{3}{8}$ inches high.

Forms 15, white, 15A, blue, and 15B, pink, are all printed alike, and are bound in the color sequence specified, in pads with substantial covers, the same general form of pad as form 2. This inspector's certification-of-inspection form is used for shapers and for repairs and minor productions. It is filled by pencil cross made by the inspector at right hand of each detail inspection line, as inspection is completed. (See also form 15C, text.)

Form 15 is kept by the inspector.

Form 15A, blue duplicate, is filled by the inspector, and sent to the boxer. After the boxing it is sent to the bookkeeper and filed by him.

Form 15B, pink triplicate, is filled by the inspector, sent to the boxer, and boxed with shipment to the customer.

Form 15C. Inspector's Memorandum of Double Turret Manufacturing Lathe. White, printed all in black. Blue dupli-

Form 15
ORIGINAL

INSPECTOR'S MEMORANDUM

POTTER & JOHNSTON MACHINE COMPANY,
PAWTUCKET, R. I., U. S. A.

Your Order No. _____

Our Order No. _____

Pawtucket, R. I. _____ 190

Shipped to _____

Destination _____

The following parts inspected by me and laid out for packing.

Signed _____

Form 15 C.

ORIGINAL.

INSPECTOR'S MEMORANDUM.

POTTER & JOHNSTON MACHINE COMPANY,

PAWTUCKET, R. I., U. S. A.

DOUBLE TURRET MANUFACTURING LATHE.

Your Order No.

Our Order No.

Shipped to *H. P. Mary Lamb* Lot No. *20* Machine No. *459*Destination, *Washington D.C.* Date Shipped, *Apr 30 1901*

Inspected by me and the following parts laid out for packing:

Signed, *John Olson*

One Double Turret Manufacturing Lathe.....	X.
One Straight Tool Holder, with three Cutters.....	X.
One offset Tool Holder, right hand, with two Cutters.....	X.
One offset Tool Holder, left hand, with two cutters.....	X.
One Cutting Off Tool.....	X.
One Boring Tool, with two Cutters and one piece of self-hardening Steel.....	X.
Four Split Turret Bushings.....	X.
Two No. 1 Morse Taper Drill Collets.....	X.
Two No. 2 Morse Taper Drill Collets.....	X.
Two No. 3 Morse Taper Drill Collets.....	X.
Two Facing Blocks and Cutters.....	X.
One Patented Lever Chuck.....	X.
Two sets of Standard Jaws for Patented Lever Chuck.....	X.
sets of Special Jaws for Patented Lever Chuck.....	X.
Turret Stud for removing Chuck.....	X.
One inch Scroll Chuck.....	X.
sets of Chuck Jaws for Scroll Chuck.....	X.
One Chuck Wrench.....	X.
One Tool Post Wrench.....	X.
One Taper Plug Chuck Spanner Wrench.....	X.
One Split Bush Wrench.....	X.
One Taper Plug for 1½ in. Expansion Bushings.....	X.
One Taper Plug for 1½ in. and 2 in. Expansion Bushings.....	X.
One Taper Plug for 2½ in. Expansion Bushings.....	X.
One 1½ in. Expansion Bushing.....	X.
One 1½ in. Expansion Bushing.....	X.
One 2 in. Expansion Bushing.....	X.
One 2½ in. Expansion Bushing.....	X.
One in. Expansion Bushing.....	X.
One in. Expansion Bushing.....	X.
One in. Expansion Bushing.....	X.
One in. Expansion Bushing.....	X.
One Expansion Sleeve for 1½ in. to 1½ in. Expansion Bushings.....	X.
One Expansion Sleeve for 1½ in. to 2 in. Expansion Bushings.....	X.

FORM 15C. INSPECTOR'S MEMORANDUM FOR DOUBLE-TURRET MANUFACTURING LATHE.

Only about half the horizontal lines of components are here reproduced.

cate, form 15D; pink triplicate, form 15E. Furnished in pads, in 3-color sequence. Size, $6\frac{1}{4}$ inches long by $6\frac{1}{2}$ inches high.

Finished products are turned in to the inspector, who inspects them, and records each detail inspection and approval by making a pencil-mark cross on right-hand margin against the piece name. This form has 69 name lines, of which the last 17 have no printed part names, but are left blank to be filled in pencil with the names of special order details. Some of these lines are not reproduced in the engraving.

Form 15C is kept by the inspector himself, in his desk in the factory. Form 15D, blue duplicate, is sent to the boxing de-

Form 17	PLEASE DELIVER THE FOLLOWING:															CHARGE TO	15-in. Shaper								
			24-in. Shaper																						
			Mfg. Lathe																						
			Mfg. Auto.																						
			Simplex																						
			Tools (New)																						
			Tools (Rep.)																						
			Equipment																						
			Lever Chuck																						
Requisition From	Turning Dep.	Milling "	Planing "	Fitting "	Bench "	Assembling	Office . .	Store . .	Woodwork'g	Blacksmith	Plant . .	Painting .	TO	Turning Dep.	Milling "	Planing "	Fitting "	Bench "	Assembling	Office . .	Store . .	Woodwork'g	Blacksmith	Plant . .	Painting .

FORM 17. FOREMAN'S REQUISITION.

partment first, and used to check the boxing, then to the book-keeper, who files it. The pink triplicate, form 15E, is usually sent boxed with the shipment to the customer.

These three forms 15C, 15D and 15E, are the same in function as forms 15, 15A and 15B, and differ only in headlines and record space.

The dimensions of this form, as used in different factories, will, of course, vary as the numbers of inspection details vary. Some equivalent of these forms 15 is indispensable, and continued patronage is wholly dependent on rigid inspection.

Form 16. Billhead. White, ruled in blue and red. Printed in black, except "All bills net as rendered," which is red. Size, $8\frac{1}{2}$ inches long by 7 inches high. All Potter and Johnston sales are billed on form 16, which has 14 entry lines. The billing items of the Potter and Johnston sales are few in number, and the space of form 16 is ample. This is filled by the bookkeeper from form 13, on which selling prices are fixed by the treasurer.

Form 16 is not shown.

Form 17. Foreman's Requisition. Thin yellow paper, printed all in black. Size, $5\frac{1}{2}$ inches long by $3\frac{3}{8}$ inches high. Filled by any department foreman.

FOREMEN'S PUNCHES.

Every foreman is furnished with a conductor's punch, each with a different cut, and as much use is made of these punches as possible. In the case of form 17, the material wanted is described in the large space below the request line; forms 17 are then punched by the foreman of the department delivering the material, and by the foreman receiving the material, the distinguishing individual punch marks certifying the transaction.

The foreman making the requisition also punches the "charge to" item space which indicates the charge.

Form 17, being dated, serves as a tracer for and date record of inter-department transactions, and changes of components from one department to another, and so avoids misunderstandings and disputes.

Forms 17 is held by the foreman who delivers the material as long as his needs require, and is then sent to the office and filed.

Besides this use of form 17 as a tracer, it is also made to serve as a cost record in case of new small-tool production for factory use. In this case the nature and weight of material are noted on form 17, with the description of the production, and form 17 goes to the cost-keeper, who adds material cost and labor cost taken from the time cards, the new tool and fixture charges being collected in a ledger account under the heading of "sales to ourselves." These new tool and fixture charges are the only costs obtained from forms 17.

Form 18. Workman's tool supply record. Stiff manila

POTTER & JOHNSTON CO.

WORKMAN'S NO. _____ NAME _____

TOOLS FURNISHED TO WORKMEN.

NO.	FILES.	MISCELLANEOUS.	NO.
	6 in. Flat Bastard	Cold Chisel.	
	6 " Flat Smooth.	Chisel.	
	6 " Pillar Bastard.	File Card.	
	6 " Round Smooth.	Hand Brush.	
	6 " Round Bastard.	Bench Brush.	
	6 " Pillar Smooth.	Thread Brush.	
	6 " Half Round Smooth.	Lead Hammer (or Raw Hide.)	
	6 " Half Round Bastard.	Set Copper Jaws.	
	8 " Pillar Bastard.	Scraper.	
	8 " Pillar Smooth.	Oil Cup (for Lard Oil.)	
	8 " Square Bastard.	Oil Cup (for Machinery Oil.)	
	8 " Round Bastard.	Right Hand Side Tools.	
	8 " Flat Bastard.	Left Hand Side Tools.	
	8 " Flat Smooth.	Center Turning Tool.	
	8 " Half Round.	Ball Turning Tool.	
	10 " Flat Bastard.	Thread Tools.	
	10 " Flat Second Cut.	Straight Cutting Off Tool.	
	10 " Flat Smooth.	Offset Cutting Off Tool.	
	10 " Half Round Bastard.	Embossing Tool (or Armstrong)	

FOREMAN.

FORM 18. WORKMAN'S TOOL RECORD.

Only about two-thirds of the horizontal lines are here shown.

card. Printed all in black. Size, 7 inches long by $7\frac{1}{2}$ inches high. Filled and signed by the workman's foreman. In the engraving, the form is shortened, some of the tool lines not being reproduced.

When a new hand goes on, his foreman punches the article space in left-hand column with his individual punch, and writes the number of pieces of the indicated tool to be issued. The workman then presents the filled form 18 to the tool-room keeper, who issues the tools to satisfy the request. When files are worn out the workman obtains new ones in exchange for the old. Upon leaving employment the workman must return his full list of tools received to the tool room, and this form 18, which is kept by the tool-room keeper, is then examined by the latter. Shortages are made the subject of inquiry by the workman's foreman; ostensibly the leaving workman's pay is not given him until missing values of form 18 have been deducted from his wages; in point of fact no such deduction from the pay of a leaving workman has yet been made at the Potter and Johnston shops.

Form 18 and its routine are undoubtedly conducive to economy of tool-room supplies, which may be very wastefully treated under lax management. Form 18 makes a sure record of supplies issued, which is its principal function. The workman knows he is charged with his supplies in black and white, on an existing sheet, and this knowledge makes him take care of his tools.

THE TOOL ROOM.

The Potter and Johnston factory has no storeroom and no storekeeper and no stores inventory, index or ledger, except the annually made inventory, which stands for a year.

Miscellaneous components, sheet metals, wire and screws are kept in the tool room, which is very large and extremely well arranged, and is in charge of a quick and competent tool-keeper.

Screws, nuts, wire and sheet metals are sent to the tool room when received, and are charged to "Miscellaneous materials" account, which is treated as an expense charge, and is, when its annual total is determined by the inventory, distributed over the entire sales product. The relative cost of these miscellaneous materials is small, and the charges against individual

productions need not be separated. Miscellaneous materials are obtained from the tool room by the presentation of forms 17, punched by a foreman.

CUTTING TOOLS.

Lathe and planer tools, drills and mills are all kept in the tool room when not in actual use. Broken tools, if forgings, are sent by the tool-keeper to the toolsmith, who reforges them, and sends them, rough, to the tool room, to be ground by the next workman using them.

Cutting tools are delivered to workmen in exchange for individually numbered workmen's brass checks, in the usual manner. No workman has any private tool-board, or stock of drills or mills, except such as he himself may bring into the shop, but the men grind the shop tools to suit their purposes, and may keep a tool as long as desired.

This cutting-tool practice is a compromise between the plan of having all cutting tools held and ground in the tool room, which is modern practice, and the old way, in which each lathe or planer hand had his own tool-board of tools, really shop property, but which were his own against all claimants, so long as the man stayed in the shop.

Both Potter and Johnston are perfectly familiar with machine-shop production routine in respect of cutting tools, and their compromise, by which cutting tools are made common property, but may yet be shaped by the user to suit his own purposes, is noteworthy. As all tools are made good by the toolsmith at the instance of the tool-keeper, the workmen lose no time in the smithy.

These details of cutting-tool supply and use are of direct interest to the factory manager and cost-keeper, as the problems included have been the subject of animated discussion, and have generally been settled by placing all cutting edges in charge of the tool-keeper, and giving workmen no choice as to the shape of cutting tools. The Potter and Johnston compromise avoids a large stock of idle cutting tools, and also avoids the objections, often well founded, of workmen to the enforced use of cutting edges not shaped exactly to their liking, and also avoids the time

losses incident to tool-dressing by the smith while the tool user waits.

TOOLS AND FIXTURES.

Tools and fixtures made for principal productions, as well as tools and fixtures for all other purposes, are charged to the "tool and fixture" account, and tools and fixtures for principal productions are given an inventory value equal to the factory cost. If discarded, special tools and fixtures are dropped from the inventory. A large depreciation is deducted from the special tool valuation each year, and new tools and fixtures made during the year have their factory costs added to the inventory.

Form 19. Piece Work Report. White paper; printed all in black. Size, 4 5-16 inches long by 5 9-16 inches high.

Successive lot piece-rate labor-cost report; filled by the bookkeeper from totals aggregated from forms 7, front, which see. Form 19 is sent to the Head, and by him filed after examination and comparison.

The function of form 19 is to give the Head information as to the precise workings of the piece rates, as in force at the current time.

Form 20. Petty Cash Disbursements. White; printed in blue; serial number in red. Size, 6½ inches long by 3½ inches high. Not engraved.

Used for all petty cash disbursements, including workmen's traveling expenses. See also form 8. Forms 8 and 20 are pinned together and filed, completing the history.

Form 21. Memorandum of Credit. Yellow paper; blue and red ruling; printed all in black. Size, 8 inches long by 5 inches high. Credit memorandum filled by bookkeeper from any voucher, and mailed to customer. Not engraved.

Form 22. Daily Coal Consumption Report. White paper; printed all in black. Size, 4¼ inches long by 5 9-16 inches high. Factory heating expense collecting form. Filled by day fireman and night watchman, and filed by the Head. Not engraved.

The Potter and Johnston factory shafting is electrically driven by current purchased from the Pawtucket Electric Co., at a cost something less than the horse power used would cost by direct steam-engine driving.

Form 23. Quotation. White; printed all in purple copying ink. Size, 8½ inches long by 10 15-16 inches high. Quotation

Form 19

POTTER & JOHNSTON MACHINE CO.

PIECE WORK REPORT.

Week ending, _____ 190

Department.

Machine.

Lot No. _____

Workman's Name _____

Workman's No. _____

Piece _____

Number of Pieces _____

Rate per Piece _____

Workman's Rate per Hour _____

Workman's Rate per Hour
under Piece Work _____

Amount added for Piece Work _____

Rate per Piece last lot of Machines,

FORM 19. PIECE WORK REPORT.

of principal-product selling price. Not engraved. The specifications of this form are identical with those of form 24.

Filled by the stenographer from instructions given by the Head, and sent to the correspondent.

Form 24.

POTTER & JOHNSTON MACHINE CO.**ORDER FOR SHOP.**

No.

FOR

Delivery promised

Lot No. Machine No. Date

DOUBLE TURRET MANUFACTURING LATHE.

Machine with standard outfit as follows: One straight tool holder with three cutters; one offset tool holder, right hand, with two cutters; one offset tool holder, left hand, with two cutters; one cutting off tool; one boring tool, with two cutters and one piece of self-hardening steel; four split turret bushings; two No. 1 Morse taper drill collets; two No. 2 Morse taper drill collets; two No. 3 Morse taper drill collets; two facing blocks and cutters. X

Patented Lever Chuck, with two sets of jaws covering all diameters from 1½ in., to 10½ in.

15-inch Scroll Chuck.

Expansion mechanism, with three taper plugs and three sizes of bushings, 1½ in., 2 in., and 2½ in. These constitute a regular set when other sizes are not specified. X

Screw cutting, with complete set of change gears.

Oil pump, oil tank and piping.

Taper attachment.

Opening die head with one pair of dies.

Extra dies, per pair.

Blank dies, per pair.

Man to start machine.

Special tools.

X IN BLANK COLUMN INDICATES PARTS WANTED.

Forms 23 are printed and filled in copying ink, and copied in a letter book kept by the bookkeeper.

Form 24. Principal-production order. Greenish blue paper. Printed all in black. Size, $7\frac{1}{2}$ inches long by $10\frac{1}{2}$ inches high.

Filled by the stenographer from letter-press copy of form 23, quotation accepted by correspondent. As many copies of form 24 are filled, by marking the detail names with a cross in the right-hand margin, as are needed to give one copy to the bookkeeper, one copy to the forge-and-foundry clerk and one copy to each foreman who will have to do with the order production, all copies being vivified by the Head.

Form 24 is the "single order" specification.

From his copy of form 24 and the lists, the forge-and-foundry clerk proceeds to determine the material needed, and to procure the same by purchase, as may be, and next delivers the material to the first-operation-department foreman, who, acting on authority of form 24, gives the material to a workman with the needed blue prints, and the workman charges his time against the order number on form 6, the foreman making the record as informed by the workman. The component is transferred to successive departments by shop laborers as directed by the foreman. Upon completion, the component goes to the assembler, who notifies the inspector, who inspects the job, and fills forms 15, 15A and 15B, which see. After shipment, forms 24 held by the factory foremen are destroyed.

Form 25. Statement. White paper. Ruled in red and blue; printed in black. Size, $5\frac{3}{8}$ inches long by $8\frac{3}{8}$ inches high. Filled by the bookkeeper and sent to customer. Not engraved.

Form 26. Departmental pay-roll distribution. White. Printed all in purple copying ink. Size, $7\frac{1}{8}$ inches wide by $12\frac{1}{4}$ inches high. Filled by the bookkeeper from the pay roll.

The bookkeeper is paymaster, and knows the factory department location of every workman, and can easily total the labor costs of each class of operations on forms 26, which are sent to the Head, after being copied in form 9, letter-press copying book, kept by the bookkeeper. The average rate per hour is found by dividing the total wages by the total hours. The "machines shipped" space is filled by the description and sales value of whatever shipments are made during the week. This

sheet shows what wages have been paid for each class of labor for the week, and what has been sent out of the factory in the week.

Form 26 gives successive weeks' total department labor costs. With the same men in work the variation should be slight. Less efficient workmen would raise the department cost by necessitating over-time to keep the work up to department requirements.

Coupled with the shipment statement for the week, the departmental pay-roll costs for successive weeks give figures for inquiries conducive to vigilance on the part of the department foreman.

CHAPTER VIII.

THE WELLS BROTHERS COMPANY, OF GREENFIELD, MASSACHUSETTS.

This concern is a large maker of taps and dies and reamers. Other productions were formerly made, but the present policy is to confine the output to the lines specified. About 185 hands are employed.

At the time this company began making taps and dies, most engineering concerns and machine shops made their own taps and dies, and the trade in this class of small tools made for sale was confined mainly to meeting the requirements of blacksmiths and wagon makers. The forms of taps and dies in common use were primitive, and good mechanics everywhere regarded the commercial tap and die as inferior articles, made to sell, possibly of use to a blacksmith, but beneath the consideration of a real mechanic.

Now all this has changed.

The factory-made twist drill is no more a standard purchase than the factory-made tap and die, which have lost all of their early characteristics except low price, and are now made in the most advanced forms, very close to size, and far superior in every way to the productions of the average machine-shop toolmaker.

The Wells Brothers Company's factory is highly organized, and the product is made and sold for sums which seem far below possibilities. The costing system recognizes minutely divided operations, and the forms, as is usual, have undergone many modifications, and those in use merit study, as much consideration has been given to adapting them to exactly meet the requirements of varied small integer value production.

From the first, all the proceedings of the Wells Brothers Company's management have been characterized by two dominant motives, hard to unite in practice. First, rigid economy is shown everywhere, and, second, there has been a steady effort made to improve the quality of the output. There has never been

at any time the slightest manifestation of that contentment with present conditions which is the sure forerunner of factory decay. New forms of product, each better than before, and new factory processes, each one labor-cost reducing, and each one making the quality of the product more certainly good, have been sought with unremitting diligence, and are now being sought eagerly, although the present product stands high in the estimation of users.

The factory management and factory routine have been made matters of first importance from the beginning, and the forms used, all original with this establishment, have been subjected to very many and great changes; the forms which did very well with only a few workmen were, of course, found inadequate as the number increased, and new methods were constantly demanded. The forms now used are apparently wide enough in scope to handle more than the 185 men at present in work.

From the first, it has been the policy of the management to give proper attention to the smallest orders, and to fill all orders as promptly as possible. There has never been a disposition to decline any production of any tap or die, no matter what its diameter, thread form and thread pitch might be, and this factory has always fully recognized the necessities of its customers in the way of promptly supplying irregular orders involving very small values, and often filled with no profit margin at all. Because of these irregular orders the factory routine must be perfectly elastic, so that unexpected production orders can pass rapidly from the correspondence, telegram or telephone message received by the office, through the factory to the shipping clerk, without injurious disturbance of the principal production routine.

Another peculiarity of the Wells Brothers' product is the constant shrinkage of the order in bulk as it goes through the factory departments. The full count of the order issued by the inspector to the first operation department usually grows less with each production step, and the forms must be such as to readily permit the record of this diminution.

OFFICIALS.

F. O. Wells, president, general factory manager and factory superintendent. He hires and discharges all hands, fixes piece rates and determines flat costs. He is the head of the manufac-

turing department, and in this chapter will be referred to as the superintendent.

F. E. Snow, treasurer and general manager, sales manager and purchase agent.

The bookkeeper, who keeps the journal, sales book, cash book and ledger, this last being loose-leaf, in a binder.

The corresponding clerk; four stenographers; two bill clerks; one receiving clerk; one paymaster and time clerk; one sales-and-shipping clerk, who has charge of the salesroom; one finished-stores clerk.

FACTORY AUTHORITY.

F. O. Wells, factory superintendent.

The assistant superintendent.

The storekeeper, who keeps both rough and finished stores, and is also the production-order clerk.

The inspector, who has several assistants, constantly occupied in gauging and inspecting. All orders in progress are counted, gauged and inspected after each operation, this calling for a vast amount of careful labor.

The rough-stores clerk; foreman of turners; foreman of screw threading; foreman of milling department; foreman of turret lathes; foreman of filing department; foreman of grinding department; foreman of hardening and tempering.

The rough-stores clerk specifies stock to be used by the cutting-off hand, the cutting-off machines being located in the rough-stores room, remote from the finished-stores room.

The finished-stores clerk delivers stores to the salesroom on requisitions from the shipping clerk, made commonly in large values.

PRODUCTION ROUTINE.

There are two forms of production, regular and special.

The regular production includes regular diameters, with standard thread forms, either U. S. standard, V, or Whitworth thread, for taps, and the regular dies, pipe taps, reamers and so on, which go to make up the very large number of productions which are listed as regular, and are carried in stock in the finished-stores room.

The special productions satisfy customers' orders, which are

generally received by mail, telephone or telegraph, often accompanied by drawings, and often calling for but one single piece of a kind, which must, of course, go through the factory on its own production order. The latter case involves in the making of the production order as much labor as or even more than in the case of a regular order for a thousand times its finished-product value.

REGULAR PRODUCTION ROUTINE.

Materials are requisitioned from the purchase agent by a form filled by the storekeeper and production-order clerk, sent to the superintendent, by him entered on another form which is sent to the purchase agent, who fills a triplicate purchase form, sends the original to the vender, keeps the duplicate, and sends the triplicate to the receiving clerk. The ordered rough stores are inspected into the rough-stores room, widely separated from the finished-stores room, by the rough-stores clerk, who fills a record form and sends it to the receiving clerk, who checks the invoice from this rough-stores clerk's record.

Regular production originates with the superintendent, who gives verbal orders to the production-order clerk, who makes production orders on forms 16 and 17, sends them to the assistant superintendent, who vises them and sends them to the inspector, who makes orders on the rough-stores clerk for materials, files the master ticket, form 16, and sends form 17, the shop order, provided with operation coupons, to the first operation department with the materials needed.

As soon as a departmental operation on an order is completed, both work and order are sent to the inspector, who gauges the work, fills the operation coupon and sends it to the paymaster, and sends the work and shop order to the foreman of the next operation department. From the last machine department the work returns to the inspector, who sends the work which needs tempering to the hardening department, and then, after tempering, to the grinders and polishers. All finished work goes from the factory to the inspector, and is sent by him to the finished-stores clerk, with the master ticket properly filled by the inspector. The master ticket is sent by the finished-stores clerk to the storekeeper, who enters the receipt on the finished-stores ledger, thus completing the production and its record.

SPECIAL PRODUCTION ROUTINE.

Special orders go from the correspondence clerk to the treasurer for credit approval, and are by him sent to the superintendent, who sends them to the production-order clerk, who fills the required master ticket and shop order, and sends the latter to the assistant superintendent, who in turn sends them to the inspector, as before, and the factory routine then becomes that of regular productions.

SALES ORDERS AND SHIPMENTS.

Orders for factory product go from the correspondence clerk to the treasurer for approval, and from him to the superintendent, and are sent by the superintendent to the storekeeper and production-order clerk, who sends the customer's order to the shipping clerk, who is in charge of the salesroom and the boxers. The shipping clerk returns the customer's order to the billing clerks, and ships the product as directed by the customer.

THE SALESROOM.

This department is located between the finished-stores room and the counting room, and is in charge of the shipping clerk; this room is equipped with drawers and shelving, and contains an assortment of finished product, packed ready for boxing. The shipping clerk keeps his sales stock good by requisitions on the finished-stores keeper, which are for considerable quantities, and so avoid numerous small depletion entries on the finished-stores ledger cards.

THE WORKMEN.

Workmen enter and leave the factory on time records made by themselves on a time recorder.

Except hardening and tempering, the work is almost wholly at piece rates.

The factory has a reading room and also a smoking room, immediately in the rear of the superintendent's office. The reading room is supplied with current publications, largely mechanical, which can be taken away by any workman for a week, by simply registering his name on a slip kept in the room in charge of the correspondence clerk. Cordial relations with the foremen are cultivated by the officials, and suggestions are not only welcomed but sought.

The earnest application of the officials to business influences the demeanor of the entire working forces.

LIST OF FORMS.

- Form 1. Machine-tool inventory card.
- Form 2. Quotation.
- Form 3. Customer's record card.
- Form 4. Sales record.
- Form 5. Superintendent's production order.
- Form 6. Storekeeper's requisition.
- Form 6A. Finished stores receipt.
- Form 6B. Salesroom requisition on finished stores.
- Form 7. Superintendent's purchase order to purchase agent.
- Form 8. Purchase agent's order to vender.
- Form 9. Purchase agent's order to vender, duplicate.
- Form 10. Purchase agent's order to vender, triplicate.
- Form 11. Materials received.
- Form 12. Stores ledger.
- Form 13. Invoice payment slip.
- Form 14. Workman's record card.
- Form 15. Piece price record.
- Form 16. Production order master ticket.
- Form 17. Production shop order.
- Form 18. Pay receipt.
- Form 19. Single operation order.
- Form 20. Minor production order.
- Form 21. Rush order.
- Form 22. Office order record.
- Form 23. Credit memorandum.
- Form 24. Pattern record.
- Form 25. Pattern record, small form.
- Form 26. Special production order and cost record, for special tool production for factory use.
- Form 27. Weekly time and production record.
- Form 1. Machine-tool inventory card. Stiff white filing card. Ruled in red, purple and blue. Printed in black. Size, 6 inches long by 4 inches high.

This form is original with the Wells Brothers Company.

All of this company's forms were originated by themselves. Forms equivalent to this plant inventory card are well known, but as the conceptions of each origination differ somewhat, comparisons are of interest. This form is expected to give always the present value of the tool whose history is recorded in its space blanks, and covers ten years of record time. The tool values are written down yearly, original values being filled from purchase invoice. These cards are filled and filed by the treasurer, in a card cabinet.

Form 2. Quotation. White paper. Printed in black. Size, $5\frac{1}{2}$ inches by $4\frac{1}{4}$ inches. Filled by the treasurer, and filed

Form 1.		Factory No.		No. of Machine	
Description of Machine Tool				Maker	
From Whom Purchased			When Purchased		Price Paid
Belling Included				Job	
Inventory Value					
	1902		1903		1904
Inventory					
Date					
Addition					
Depreciation					
	1905		1906		
Inventory					
Date					
Addition					
Depreciation					
	1907		1908		1909
Inventory					
Date					
Addition					
Depreciation					
	1910		1911		
Inventory					
Date					
Addition					
Depreciation					

FORM 1. MACHINE-TOOL INVENTORY CARD.

with letter of inquiry, in vertical filing cabinet, in the treasurer's office. The selling prices are quoted in reply to inquiry. The estimate on the back is instantly available for future reference.

All prices and the factory costs are fixed by the treasurer, who obtains flat costs from the cost clerk's records, and adds expense percentages to obtain factory costs, and profit percentages to fix selling prices.

The estimate on the back of form 2 is in manuscript, and varies, of course, in each case.

Vertical filing, in folders in cabinet drawers, is used, this

form of filing being now preferred to the horizontal placing of written papers.

Form 3. Customers' record card. Stiff buff card. Ruled in red and blue. Printed in black. Size, 5 by 3 inches.

Every customer's name and address is entered on form 3, with particulars, by the treasurer. Forms 3 are filed in a cabinet

Form 2.

QUOTATION.

Date _____

To Whom _____

Address _____

Description of Goods.	Price.

Figuring, see other side.

FORM 2. QUOTATION.

by the treasurer in his office, and from these records forms 4 are filled.

Form 3 records are of the highest commercial value, because the buyer of factory product is the object sought by the factory. The procurement and retaining of the customer is of vital importance to the factory, and the factory product is only a means for obtaining the product buyer's favor. The end and object of

282 *FACTORY MANAGER AND ACCOUNTANT.*

the factory is payment for sales of factory product, and the record of customers is a principal form in organized factory practice.

Form 4. White, stiff card. Ruled in red, black and blue.

City or Town		Form 3.	State	Rating
Name				
Street				
Discounts				
REMARKS				

FORM 3. CUSTOMER'S RECORD CARD.

STATE	NAME						Form 4.
TOWN							
JANUARY							
FEBRUARY							
MARCH							
APRIL							
MAY							
JUNE							
JULY							
AUGUST							
SEPTEMBER							
OCTOBER							
NOVEMBER							
DECEMBER							
TOTAL							
YEAR	1900	1901	1902	1903	1904	1905	

FORM 4. SALES RECORD.

Printed all in black. Size, 6 inches long by 4 inches high. This is a geographical and monthly product sales record, and is

made in the form shown to indicate the most likely field for the efforts of traveling salesmen for a given month. Filled from forms 3 by the treasurer and filed in card cabinet in his office.

There are, and probably always will be, two distinct forms of recompense for traveling salesmen. Where the price of the factory production unit is large, and the sales are consequently few in number, as for instance in the case of bridges, the traveling salesman is commonly paid by salary, to which a sales percentage may be added. Where the production unit value is small, as in the case of the Wells Brothers Company's product, the sales are, for the whole year together, constantly increasing in total value, and this increase should show in every territorial district, if covered by a capable salesman. The sales in a certain district may vary very largely with the seasons, but for the year should regularly increase, and it is probably better in this case to recompense the salesman by commission than by salary. In any case it is of the highest importance to keep such records as will certainly determine the efficiency of the salesman, and the district and month must both be considered in connection with the traveler's monthly totals of sales. Form 4, filled from form 3, is extremely important. The factory needs to be informed of a falling off in sales totals in a district where trade has once been established, as promptly as possible, and form 4 gives this information, and is a sure guide to the employment and placing of traveling salesmen.

Form 5. Thin white paper; blank. Size, $5\frac{1}{2}$ by $4\frac{1}{4}$ inches. Form 5 is filed by the production-order clerk from the factory superintendent's dictation. The date is a rubber stamp impression. The order, in the example shown, is for 500 taper taps, United States standard form of thread, 9-16 inch diameter, 12 threads per inch. So far the record is from dictation. From his own knowledge of what is most convenient, the production clerk divides the 500-tap order into two factory orders for 250 taps each, these orders being numbered 610A and 610B. In point of fact this dictation was made by the assistant superintendent and this fact is noted by the order clerk by the "per Jones." This manuscript is written in red ink. It is highly important to the factory that this order should be immediately recorded in the stores card inventory, which is kept by the production-order clerk, who is also the storekeeper, and has both rough and finished

stores in his keeping, and who fills the stores inventory or ledger cards, which are filed in a card cabinet at the back of his chair, so that he can turn from his desk to the cabinet with the least possible exertion. To make this entry certain, the red ink manuscript of form 5 is noted "Ent." in black, with a black bracket including both divisions of the production-order memorandum, and no production order leaves the order clerk's desk until after it has had its record card, form 12, filled and placed in its proper tray in the

Form 5.

DEC 13 1902

Order

500 $\frac{9}{16}$ -12 vss Taper

610 A 250 } ent

B 250 }

per Jones

FORM 5. SUPERINTENDENT'S PRODUCTION ORDER.

stores-ledger cabinet. This cabinet has eight card drawers to take cards the size of form 12, and the whole cabinet is mounted on wheels so that it can be run into the fireproof brick vault at the end of the superintendent's office floor at night. The factory is extremely low, as no traveling cranes or anything in the way of lifts are needed, and there is almost nothing to burn, so that this brick vault gives the stores-ledger and all other important factory records and gauges a good protection against fire.

THE PRODUCTION-ORDER CLERK.

In this factory a very great number of production orders must be written, because no order, no matter how small in value, is refused on account of its variation from usual practice. A tap or die may be of any diameter and have any number of threads per inch, and these threads are regularly made in V, United States standard and Whitworth forms, and there are also square threads and various other thread forms not included in general machine practice. Again, an order may be for a special form of tap having only a very small selling value; while such orders are far from desirable they must be filled, and if filled must go through the factory on a production order, and the cost to the factory of making the production order, which should in all cases be as small as possible, must in case of a very small product value be reduced to the lowest possible terms, as this company fills many special orders in which the selling price leaves nothing to spare for anybody.

This same necessity of production-order cost reduction exists in all factories, and is not at all dependent on the factory product unit price. Thus, in the case of the Beaman & Smith factory product, the unit is a special milling or boring machine, selling always for some hundreds of dollars, and sometimes for some thousands of dollars, so that at first sight it might seem as if the mere cost of the production order was a matter of small importance. But as shown in the Beaman & Smith costing it appears that the only production cost reduction possible lies in reducing the labor of making the production order, because the production order must use the lists, and the lists follow the drawings, and it is only in the reduction of the drawing costs that the total machine production costs can be reduced. Consequently, the Beaman & Smith practice is quite indifferent to detail costs of factory operations, and makes no effort to record operation costs, and the management devotes all its energies to lowering the cost of the production order, by reducing the cost of the drawings from which the lists are filled.

From these two examples of Wells Brothers Company and Beaman & Smith it is safe to say that in case of repetition products, operation costs are of first importance in factory economics,

and nothing but a very careful comparison of operation costs can lower the product flat cost, but in case the production is not composed of repetition components, then operation costs may be disregarded, and indeed must be disregarded, because the operations are not on similar pieces, and hence afford no basis for comparisons. The mere obtaining of operation costs is of no value whatever; if a cost cannot be compared with another cost made under substantially identical conditions, it is of no use to the factory economist, and its record cost is simply money thrown away and should never be made. It is useless for the cost-keeper to waste his energies in making detail records of costs which cannot be decreased, as the only use of records of unavoidable costs is to aid in intelligent estimating, and for estimate purposes gross costs only are useful.

TABULATION DESK TOPS.

Returning from this consideration of production-order cost at large to the Wells Brothers' production order, it will be noted that a single production order may call for a sales value of several hundred dollars, as in case of a regular stock order for 500 or 1,000 taps of regular form, or for a product value of only part of one dollar, as in the case of a small special tap, and the production order itself must cost about the same for each production, or may even cost more for the single special tap than for the large number of regular taps, so that this company must make the production order as cheaply as possible. All dimensions of the threads for every pitch and diameter are given in inch parts, and as these dimensions involve quite elaborate calculations, they are tabulated in black ink manuscript on white sheets of paper covering the entire top of the production-order clerk's desk, these sheets being again covered with a slab of thick glass, through which the tables of figures can be read as easily as if the glass were absent. The glass keeps the sheets clean, and also makes a clean, smooth and in every way suitable desk top for the use of the production-order clerk.

There are many cases where the production-order clerk must refer to many lists and tables, and it is hard to conceive of a more convenient place for these reference tables than under a glass slab, say one-fourth inch thick, forming the top of the desk on

which the orders are written. This placing of lists and tables in constant use may not be absolutely novel, but it is certainly extremely convenient, and should be carefully considered. For manuscript tables of the large sizes which are often most convenient, nothing could more perfectly exhibit and preserve these costly sheets, than to lay them on top of a desk and cover them with glass. The tables on this particular desk give about 4,000 dimensions, and are more easily referred to than seems possible with any other placing.

STORES ROUTINE.

Form 6. Wanted. White, thin paper. Printed in black. Size, $3\frac{1}{8}$ by 5 11-16 inches.

Storekeeper's requisition on purchase agent for stores replenishment. The production-order clerk is the storekeeper, and has charge of both rough and finished-stores ledgers, and so knows the factory requirements, and is the proper person to notify the purchase agent of factory needs. The first space line is filled in manuscript by the storekeeper's name, next is a rubber stamp date line, then specification of material, followed by memorandum of stores residue. The "Ordered of" space is filled with the name of the factory head, who vivifies the order with a rubber stamp (also used for correspondence), and fills form 7 from form 6, which he files and then sends form 7 to the purchase agent.

At this time, some rough stores are not entered on the stores ledger. Such stores are requisitioned by the foreman of the departments where they are mainly required, by filling form 6 and sending it to the purchase agent, who is the treasurer, and has authority to vivify form 6. In this case the treasurer files form 6. The stores not recorded on the storeroom ledger consist mainly of boxes of lumber, pasteboard boxes and wrapping paper, and comprise only small values, and may be well disposed of by charging the costs directly to expenses.

Form 6A. Finished-stores receipt. Pale yellow. Printed all in black. Size, $2\frac{7}{8}$ by $5\frac{1}{2}$ inches.

Filled by finished-stores clerk from inspector's count sent to him with finished work by the inspector. Sent by stores clerk to storekeeper, who makes a corresponding entry on the stores-ledger form 12, and destroys form 6A.

Form 6 B.

REQUISITION FOR STOCK

Date DEC 28 1902 No. _____

Articles _____

✓ 100 $\frac{9}{16}$ -12 USS

Taper Taps

Name M. D. Howland.

Return slip to office.

FORM 6B. - REQUISITION FOR STOCK.

Form 6 A.

STOCK RECEIVED.

Date DEC 28 1902 No. _____

Articles _____

✓ 240 $\frac{9}{16}$ -12 USS

Taper Taps

Name O. J. Brooks.

Return slip to office.

FORM 6A. FINISHED-STORES RECEIPT.

Form 6.

WANTED

By whom Francis

Date DEC 18 1902

DESCRIPTION OF GOODS

$\frac{5}{8}$ annealed Steel

25 bars left in stock

Please mark your reply:
For F. O. WELLS, Supt.

Ordered of F. O. Wells

Rec'd by _____

Date _____

Leave this slip in office.

FORM 6. STOREKEEPER'S REQUISITION.

Form 7.

REQUISITION FOR STOCK

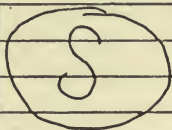
FACTORY NO. 1

FACTORY NO. 2

DATE *Dec 18th* 190 *2*

Quantity

Description of Goods. WANTED

*100**Bars 5 Annealed Steel**Approved 12/13*
ordered 12/14/02**RECEIVED****DEC-13-1902****ANSWERED**

Please mark your reply:

For F. O. WELLS, Supt.

Give full Description of goods. Sizes, Numbers, and all information necessary for proper ordering.

Form 6B. Salesroom requisition on finished stores. White. Printed all in black. Size, 2 15-16 by 5½ inches high.

Filled by sales clerk, and sent to finished-stores clerk, who satisfies form 6B with finished stores, and then sends it to the storekeeper, who makes a corresponding entry on the stores-ledger form 12, and destroys form 6B.

Form 7. Factory superintendent's order to purchase agent. White. Printed all in black. Size, 5½ by 8½ inches.

Filled by the factory superintendent from form 6, and vivified by his rubber stamp, and then sent to the purchase agent, who dates it with his correspondence stamp, and fills forms 8, original; 9, duplicate, and 10, triplicate, to satisfy form 7, and files form 7, authorizing the purchase, in his desk.

Form 8. Purchase agent's demand on vender. White paper. Printed in black; serial number in red, triplicate pad form; original white, duplicate yellow, and triplicate thin, pale brown paper. Size, 8¾ inches long by 6 inches high.

Filled and signed by the purchase agent, who fills forms 9 and 10 at the same writing. Form 8 is mailed to the vender.

Form 9. Yellow paper. Carbon duplicate of form 8, filled by the purchase agent at writing of form 8. Same size as form 8. Bound in pad book so as to remain bound when the perforated forms 8 and 10 are torn out. This book of blank forms 8, 9 and 10 is kept by the purchaser agent in a drawer of his desk, and forms his record of all purchases made by him. This form is not shown.

Form 10. Thin, pale brown paper. Carbon triplicate of form 8, filled by the purchase agent at the time of writing form 8, torn from pad book and sent to the receiving clerk, and held by him until satisfied by the receipt of form 11. The latter is filled and signed by the rough-stores clerk, who counts, weighs or inspects the rough stores into the rough-stores room. This form is not shown.

Invoices are sent by the treasurer to the receiving clerk, who checks them from forms 10 and 11, and returns them to the treasurer, who holds them until the earliest due date in a drawer in his desk, and then satisfies them with a check, accompanied by the invoice and form 13, filled by the treasurer. No invoice is held unpaid more than thirty days after receipt of material.

Form 8.

THIS NUMBER MUST
APPEAR ON INVOICE

ORDER

NO. 999

PURCHASING DEPARTMENT
WELLS BROTHERS COMPANY.

OFFICE and FACTORY,

GREENFIELD, MASS., U. S. A.

*December 14 1902*M *John Smith*
Boston Mass
Please send us by freight *B & M R. R.**100 Bars Annealed tool Steel*RENDER INVOICE AT LOWEST CASH PRICE
STATING CASH DISCOUNT.
WE PAY NO BOXING OR CARTAGE.

WELLS BROTHERS COMPANY.

BY

Johnson

FORM 8. PURCHASE AGENT'S ORDER.

Form 11. Stock received.—White paper. Printed all in black. Size, $5\frac{1}{2}$ by $8\frac{1}{2}$ inches.

Filled by the rough-stores clerk from actual count, weight and inspection, signed by him, and sent to the storekeeper, who makes corresponding entries on the stores-ledger forms 12, and then sends forms 11 to the receiving clerk, who checks invoice and the triplicate purchase form, form 10, by form 11, and files forms 10 and 11 together in his own file, and returns the invoice to the treasurer.

Form 11		
STOCK RECEIVED		
<hr style="border: none; border-top: 1px solid black; margin-bottom: 5px;"/> Date Received _____		
From Whom _____		
Bars _____ Bbls. _____ Boxes _____ Bags _____		
No. Pieces	Description of Goods	Weight
<hr style="border: none; border-top: 1px solid black; margin-bottom: 5px;"/> Checked by _____		
Fill Out and Return to Office		

FORM 11. STOCK RECEIVED.

The central portion of the original is not shown.

THE ROUGH-STORES ROOM.

The rough-stores room is in charge of the rough-stores clerk, and is fitted with cutting-off machines of various kinds, and with racks for bars, and has a considerable floor space for boxes and barrels in which rough stores of castings and so on are held until wanted. When material requisitioned on form 6 reaches the rough-stores room it is received by the rough-stores clerk, who fills the "Received by" space of form 6, and then sends form 11 to

the receiving clerk. "Cutting-off" orders are sent directly to the man who runs the cutting-off machines, but he cannot take bars from the racks in the same room and cut them up, but must present his cutting-off order to the rough-stores clerk, who directs the selection of bars from which the cutting-off order is to be filled. This places the responsibility for use of proper material on the rough-stores clerk, and at the same time brings both the clerk and the tender of the cutting-off machines into the transaction. The bars are racked in the rough-stores room as follows: At the left, annealed tool steel; next, unannealed tool steel; then a narrow rack for iron bars, of which some use is made; then come the machine-steel bar racks; and last, at the extreme right, cold-rolled and drawn machine-steel bars.

Tool-steel bars are not so marked as to distinguish them with certainty from other metal bars. In some factories tool-steel bars are marked by painting the ends red. If every tool-steel bar has a red paint stripe applied to its whole length when received in the storeroom, then every piece of that bar, no matter how short, is always labeled "tool steel," and the chances of mistakes are lowered. Few factories using both tool-steel and machine-steel bars unmarked escape errors made by substituting one for the other, as the eye can detect no difference, except by the aid of special marks.

Very few factories follow the plan of giving every tool-steel bar which comes into the stores a whole-length distinguishing mark, so that every piece of the bar will always tell what it really is. Most managers are content with simply painting one end of the tool-steel bar red, and ordering the bar to be cut, as used, from the unpainted end. This is not enough, as a piece once cut from the tool-steel bar cannot be distinguished with certainty, from a machine-steel bar of the same form and length. The Wells Brothers' factory is certainly very carefully managed, but while the writer was talking with the inspector in the inspection room, a messenger from the tempering department appeared with a finished special tap, which had been heated and quenched without hardening. The inspector said it was made of machine steel. Of course there was nothing to do but to make the tap over again. The inspector said he could tell whether a bar was tool steel or machine steel by testing it with an emery wheel. In this case the

waster had been sent from the rough-stores room to the inspector as tool steel, and had been sent by the inspector through the turning, threading and milling departments, and none of the highly expert artisans through whose hands this waster had passed had any suspicion that it was not tool steel until it refused to harden, and had to be remade, causing a delay in filling the order and an-

GREENFIELD, MASS.,_____

Form 13

Gentlemen:

Enclosed please find our check.

No. _____ Packard National Bank of
Greenfield, Mass., for invoices as stated
below.

WELLS BROS. & CO.

DATE OF INVOICE.	AMOUNT.	CASH DISCOUNT	NET AMOUNT

Receipt *Identical* Bills enclosed and
return with this slip to us first mail.

FORM 13. INVOICE PAYMENT SLIP.

noying the superintendent by showing defective routine. If the inspector knew that each and every piece of tool-steel bar in the factory, no matter what its length, had a red paint mark on it, this waster would never have been sent by him into the factory.

The only case where tool-steel bars can be at all safely left unmarked in the factory, is where tool steel is stored in a room by

itself, in its own racks. Even in this condition of seclusion and separation a bar of mild steel may be accidentally racked with the tool steel, and may so cause an exasperating failure.

It is some work to make a red paint mark the whole length of some hundreds of tool-steel bars, but it is not so disquieting to the management as it is to do a lot of work on a piece that has to be thrown away, because it cannot be hardened after finishing.

Form 12. White, stiff card, cut for filing rod. Ruled in blue, black and red. Size, 8 by 5 inches.

Filled and filed by storekeeper in wheeled cabinet, which stands through the day at the back of his chair. At night the

Form 14	
Name _____	Street _____
No. _____	Married _____ Single _____
Date commenced work _____	Day _____ Piece _____
Wages \$ _____ Per Day, 10 Hours	
Recommended by _____	
RECORD OF CHANGES	
Remarks _____	○
Date left our Employ _____	

FORM 14. WORKMAN'S RECORD CARD.

stores-ledger cabinet, with other card files placed on the shelves in its base, is wheeled into the fireproof vault at the end of the superintendent's office.

The usual maximum and minimum spaces of form 12 notify the storekeeper of the necessity for stock replenishment.

While other forms of stores records may be used with much success, it will be noted that the card inventory is generally most relied upon, and is most accessible.

Form 13. Invoice payment slip. White, thin paper. Printed all in black. Size, $3\frac{1}{4}$ by $5\frac{3}{8}$ inches.

Filled by the treasurer and sent with invoice and check to

satisfy, to the vender, who returns invoice and form 13 to the treasurer.

Form 14. Employee's record. Bright saffron red, stiff card. Printed all in black. Size, 4 15-16 by 2 15-16 inches.

Filled and filed by paymaster in card cabinet. This important form is very carefully filled by all well-organized factories.

Form 15. White, stiff card; cut for filing rods at ends. Printed all in black. Size, 8 inches long by 5 inches high. Operation piece rates for tools of diameters specified by column headings.

Filled by factory superintendent, and filed in paymaster's cabinet. A very large proportion of the work in this factory is at piece rates, and a ready reference table of piece rates is necessary for the use of the paymaster, who has an enormous number of piece-rate credits to workmen to verify. This form 15 is simple and direct, and something of the kind is indispensable where small value piece-rate operations are the practice of the factory.

PRODUCTION-ORDER ROUTINE.

Form 16. Master ticket. Manila paper. Printed all in black. Size, 5 11-16 inches long by 19 11-16 inches high. Perforated so as to separate at the line AB. Shown in two parts. See also form 17.

Forms 16 and 17 are filled by the production-order clerk, who also acts as storekeeper, at his desk in the superintendent's office. Rubber stamps are used as far as possible in filling forms 16 and 17, only single-number type being used. These types are very large, and have their impressions located by hand, without guides. This enables the production-order clerk to work rapidly.

This "Master Ticket" is a production-order notification and department order tracer; it is sent to the inspector, and by him filed in suspended spring clips. As fast as lots worked in the factory on production orders made on forms 17 pass through a department, form 17 is brought, in its box, to the inspector, with the partly finished work, and he gauges each individual piece for diameter, and inspects it for length and general fitness. The diameter must be correct, and if it gauges under size, the piece is "made over" into a smaller diameter. These "made over" blanks are held in boxes by the inspector, sorted, until he can place them

in subsequently received orders. No notice is taken of this irregularity in the costing of the lot which is diminished by the abstraction of the "made overs." The diameter errors occur mostly in threading, and the "made over" tap blank is often shorter than its original length, being sent to the cutting-off machines to give it the standard length for its unintended smaller diameter. The result of all this is, of course, to over-charge the order from which "made over" blanks are taken, and undercharge the order which is made up to full number with the injected "made over" blanks. But the errors in costing are small, and do not in any way affect the factory commercially.

Each production order is vised by the assistant superintendent, who sends the production order to the inspector.

The production-order routine is by written orders from the superintendent to the assistant superintendent, which are by him verbally transmitted to the production-order clerk.

The very large rubber hand stamp type used for numeral impressions on forms 16 make the type easy to handle, and make the impressions easily read. For convenience in handling the work in the factory, the principal order is divided into sections, marked "A," "B," "C" and so on, as many forms 17 being filled for one form 16 as may be desirable, the department space lines being seven in number, lettered to "G." The principal orders often call for a great number of pieces, and may be months in the factory before being completely satisfied. The whole factory routine is ordered with reference to the "special" order production, which is an unknown and undiscoverable quantity. Any mail may bring special orders which will disarrange almost the whole regular production throughout the entire list of factory departments for a considerable period, or again, quite a long time may pass in which the special orders interfere very little with the regular production. Hence the large regular production orders, which are always enough to keep the factory busy for a long time to come. All regular product is always largely in stock in the finished stores, and so regular orders can always be side-tracked in the factory, as they must be in order to satisfy special orders with all possible dispatch.

Form 16 is shown as filled to order the factory production of 500 taper taps, 9-16 inch in diameter, 12 threads per inch, United

Form 16		MASTER TICKET		Taps			
DATE <u>DEC. 13 1902</u>			ORDER NOS.				
M. T. NO. <u>992-</u>			FROM <u>A</u> TO <u>B</u> INC.				
SIZE.	THREAD.	FORM.	Right or Left.	KIND			
9 1 6	12	U. S. S.	RIGHT.	TAPER.			
NO. ORDERED		NO. ISSUED TO		REMARKS			
500		TURNING <u>250</u>					
NO. RECEIVED		THREADING _____					
		MILLING _____					
		HARDENING _____					
<div style="display: flex; justify-content: space-between;"> A TURNING B </div>							
ORDER NO.	DATE ISSUED	NO. ISSUED	DATE FINISHED	No. Finished	MADE OVER	SPOILED	
A	<u>Dec</u>	<u>13</u>	<u>250</u>	<u>Dec</u>	<u>15</u>	<u>245</u>	<u>5</u>
B							
C							
D							
E							
F							
G							
THREADING							
ORDER NO.	DATE ISSUED	NO. ISSUED	DATE FINISHED	No. Finished	MADE OVER	SPOILED	
A	<u>Dec</u>	<u>15</u>	<u>245</u>	<u>Dec</u>	<u>20</u>	<u>243</u>	<u>2</u>
B							
C							
D							
E							
F							
G							

FORM 16. PRODUCTION-ORDER MASTER TICKET.

First part, joined to second part along bottom line.

MILLING.

ORDER NO.	DATE ISSUED	NO. ISSUED	DATE FINISHED	No. Finished	MADE OVER	SPOILED
A	Dec. 20	243	Dec. 24	240		3
B						
C						
D						
E						
F						
G						

GRINDING RELIEF.

ORDER NO.	DATE ISSUED	NO. ISSUED	DATE FINISHED	No. Finished	MADE OVER	SPOILED
A	Dec. 26	240	Dec. 27	240		
B						
C						
D						
E						
F						
G						

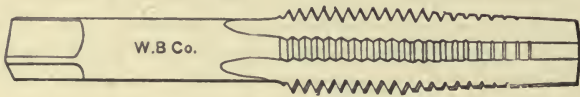
GRINDING FLUTES.

ORDER NO.	DATE ISSUED	NO. ISSUED	DATE FINISHED	No. Finished	MADE OVER	SPOILED
A	Dec. 27	240	Dec. 28	240		
B						
C						
D						
E						
F						
G						

GRINDING SHANKS.

ORDER NO.	DATE ISSUED	NO. ISSUED	DATE FINISHED	No. Finished	MADE OVER	SPOILED
A	Dec. 28	240	Dec. 28	240		
B						
C						
D						
E						
F						
G						

FORM 16. PRODUCTION-ORDER MASTER TICKET.
 'Second part, joined to first part along top line.

Form 17.				
SHOP ORDER				
No. 992-A		Date DEC 13 1902		TAPS
SIZE. 9 1 6	THREAD. 1 2	FORM. U.S.S.	Right or Left. RIGHT.	KIND. TAPER.
STOCK. ORDER				
NO. ORDERED.	NO. ISSUED TO		REMARKS.	
250	TURNING <u>250</u>			
NO. RECEIVED.	THREADING <u>245</u>			
<u>240</u>	MILLING <u>243</u>			
	HARDENING <u>240</u>			
				
A		B		
GRINDING FLUTES <u>Black</u>		GRINDING SHANKS <u>Lamson</u>		
ISSUED <u>240</u>		ISSUED <u>240</u>		
SPOILED		SPOILED		
KIND TAPER.		KIND TAPER.		
SIZE <u>9/16</u>		SIZE <u>9/16</u>		
INSPECTED <u>O'Keefe</u>		INSPECTED <u>O'Keefe</u>		
DATE <u>Dec 28</u>		DATE <u>Dec 28</u>		
ORDER NO. 992-A		ORDER NO. 992-A		

FORM 17. SHOP PRODUCTION ORDER.
First part, joined to second part along bottom line.

States standard form, right-hand thread. The production-order clerk fills form 16 entirely with rubber stamps, except the "from A to B inclusive," the A and B being in manuscript.

Form 16 is sent, with form or forms 17, which see, to the inspector, who probably issues an order to the cutting-off depart-

MILLING <i>Jackson</i>	GRINDING RELIER <i>Franklin</i>
ISSUED <i>243</i>	ISSUED <i>240</i>
SPOILED <i>3</i>	SPOILED
KIND TAPER.	KIND TAPER.
SIZE <i>$\frac{9}{16}$</i>	SIZE <i>$\frac{9}{16}$</i>
INSPECTED <i>Bickford</i>	INSPECTED <i>O'Keefe</i>
DATE <i>Dec. 24</i>	DATE <i>Dec 27</i>
ORDER NO. 992-A	ORDER NO. 992-A
TURNING <i>Bond</i>	THREADING <i>Pratt</i>
ISSUED <i>250</i>	ISSUED <i>245</i>
SPOILED <i>5 made over</i>	SPOILED <i>2</i>
KIND TAPER.	KIND TAPER.
SIZE <i>$\frac{9}{16}$</i>	SIZE <i>$\frac{9}{16}$</i>
INSPECTED <i>Weymouth</i>	INSPECTED <i>Smith</i>
DATE <i>Dec. 15</i>	DATE <i>Dec. 20</i>
ORDER NO. 992-A	ORDER NO. 992-A

FORM 17. SHOP PRODUCTION ORDER.

Second part, joined to first part along top line.

ment for 250 blanks, as called for by section A of the forms 17, and notes this 250 on form 16 as issued to the turning department when he sends the blanks with section A of forms 17 into the turning department. He sends the remaining 250 blanks into the factory later. As the operations are completed the work and

form 17A are returned from the completed-operation department to the inspector, who fills the department operation record spaces as he finds the pieces, the number of pieces always diminishing in going through the works.

When the lot returns to the inspector from the shank grinders, his "No. Finished" space filling giving the number of survivors, in this example, 240 out of the original 250 blanks sent to the turners, he separates form 16 at the "AB" line of perforations and sends the top part with the finished work to the finished-stores clerk, who counts and stores the product, and fills the "No. Received" space, and then sends the completed top part of form 16 to the stores clerk and the assistant superintendent, whose desks are adjacent in the factory superintendent's office. The storekeeper at once enters the storeroom receipt of finished product on its proper stores-ledger card, and the assistant superintendent is advised of the completion of the order.

When the inspector separates form 16 on the line AB, he sends the lower portion to the assistant superintendent with form 17, in case only one form 17 is used with this particular form 16, as the order is then satisfied. But if two or more forms 17 are used with one form 16, then the inspector does not separate form 16 into two parts until the final form 17 has reached him, accompanied by the last lot of work needed to satisfy the full requirements of form 16, but separates form 17 on the line AB, and sends the top part to the stores clerk and the bottom part to the assistant superintendent and storekeeper.

The assistant superintendent is thus given the history of the production in detail, and can investigate the factory operations intelligently.

Form 17. Shop order. Manila paper. Printed all in black. Size, $5\frac{7}{8}$ inches long by $13\frac{1}{2}$ inches high. Shown in two parts.

Production-order "Shop order." The Wells Brothers Company's production order really consists of at least two pieces of paper, and may be made up of several pieces, consisting of one filled form 16, and as many filled forms 17 as are needful to divide the order into convenient lot parcels. As shown in these two filled examples, the master ticket calls for 500 taps, form 16, while form 17 calls for 250 taps, it being supplemented by a duplicate, calling for the remaining 250. Form 17 is filled by the production-order

clerk at the time of filling the master ticket, and enough in number of forms 17 are filled at the same time to correspond in total of pieces with form 16.

Form 17 is perforated so as to be easily separated into operation coupons by the inspector, who notes the number passing inspection on the last operation coupon and the next operation coupon, and tears off the completed operation coupon and sends it to the paymaster, who uses it in determining the workman's pay, and files the coupons for a time in operation bundles. The shop-order stub, form 17, remaining after all the coupons are separated from it, is marked by the inspector with the number of perfect pieces finished, and sent with them to the finished-stores clerk, who notifies the storekeeper of the stores replenishment by sending the form 17 stubs to him. The stores ledger is then written up from the stubs, and the stub is destroyed after a time.

The heads of forms 16 and 17 are similar, down to the "AB" line of perforations, varying in number and head line, but each telling the same story, form 17 partly, and form 16 entirely reciting the transaction.

These two forms, 16 and 17, as used, make a perfectly flexible production order, and satisfy a very difficult assemblage of unknown possibilities. The execution of the order can proceed promptly, or it may be interrupted for any length of time without causing any confusion whatever. In point of fact, a principal order may be a year or more in progress in the factory. The forms 16 are kept clean and in good condition by suspension from spring clips, and the forms 17 are protected by their wooden cases, so that form 17 can be safely set aside in the box with the partly finished work it calls for, until the factory is ready to resume the work of production. Much trouble came from defacement and loss of forms 17 until after the devising and use of the wooden form case, which cured all the disorders incident to the use of form 17, and makes this variable use of forms 16 and 17 satisfactory to the company manager.

THE SHOP-ORDER CASE.

The shop order, form 17, must go with the work through the factory departments, and orders are often in the factory for months before they are completed, as "rush" orders are constantly

wooden swinging cover $\frac{1}{4}$ inch thick, on top of the first one. This second cover is $6\frac{1}{2}$ inches long by $4\frac{1}{4}$ inches wide, and has a square opening cut in it, through which the "Rush Order" face can be read. The protection afforded by this wooden case ensures the preservation of forms 17 for any length of time, and thus makes the use of this large, frail, coupon production order practicable.

Form 19.	
ORDER.	
To whom given _____	
Work on _____	
Job Numbers _____	
Number ordered _____	
Date _____	
Number done _____	
Date _____	
Price each _____	Total amount, \$ _____
Approved by _____	
Charged to _____	
On order, number _____	

After this has been approved, send to office, with your WEEKLY TICKET.	

FORM 19. SINGLE-OPERATION ORDER.

Form 18. Memorandum. White paper. Printed all in black. Size, $3\frac{3}{8}$ by $5\frac{1}{2}$ inches.

Filled by the paymaster, and sent to workman in advance of pay day, and presented, signed by the workman as correct, to the paymaster at payment. The payment is on Saturdays, up to the previous Saturday night. This gives ample time for the filling of form 18 with the statement of workman's earnings and deduc-

tions, and for the adjustment of claims. Form 18 is called "The Receipt," and is filed by the paymaster after payment.

Form 19. White. Printed all in black. Size, $3\frac{1}{8}$ by $5\frac{1}{2}$ inches. Single-operation order.

Filled sometimes by production-order clerk, but used principally by the inspector, who fills it and sends it to the rough-stores cutting-off machine tender, who satisfies form 19, and returns it

Form 20.

SHOP ORDER.

To whom given, _____

Date _____

WHAT FOR.

Weight, _____ lbs., _____

Put your time on this ticket every day and
return to office Saturday Night.

	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
Hours						

Total cost, \$ _____

FORM 20. MINOR-PRODUCTION ORDER.

with the material to the inspector, by whom the pieces are counted. Form 19 is then sent to the paymaster. As the cutting off is at piece rates the operation cost is fixed.

In case of other single-operation orders made on forms 19, the routine is similar. In case this form is used for production at day rates the time record is made by the department foreman.

Forms 19 are used by the paymaster in making the pay-roll, and finally destroyed by him.

Form 20. White paper. Printed all in black. Size, $3\frac{1}{4}$ by $5\frac{1}{2}$ inches. Minor-production order, or sub-production order.

Filled by the assistant superintendent or by a department

Form 21.

RUSH ORDER

Ordered _____

Date promised _____

Cutting _____

Turning _____

Threading _____

Milling _____

Filing _____

Hardening _____

Polishing _____

Date shipped _____

FORM 21. RUSH ORDER.

foreman. This is a day-rate form, and is handled in the same way as form 19, which see.

Form 21. Rush order. Yellow paper. Printed all in black. Size, 3 by 4 inches.

Filled by the production-order clerk. Form 21 is always used as a rider for some other form of production order, commonly made on form 17, which see. Form 21 gives precedence

to the order which it accompanies, goes to the inspector with the finished product, and is by him sent to the assistant superintendent, who notes date of completion, and makes unwarranted delays

Form 22.

OFFICE ORDER.

By whom ordered _____

City _____

State _____

How sent-

Post _____

Express _____

Freight _____

To whom sent _____

GOODS.

FORM 22. OFFICE-ORDER RECORD.
Some of the blank portion of form is not shown.

Form 23

CREDIT MEMORANDUM.

Credited to _____

By WELLS BROTHERS COMPANY,

GREENFIELD, MASS.

FORM 23. CREDIT MEMORANDUM.
Some of the blank portion of form is not shown.

the subject of remark. It is destroyed by the assistant superintendent.

Form 22. Yellow. Printed all in black. Size, 6 by 8 inches. Telephone or telegram order record, filled by the correspondence clerk, and sent to the salesroom.

The larger portion of orders are filled directly from correspondence, without transcription on any factory form. Form 19 is used only where demanded to secure certainty. It is sent with the order satisfaction to the shipping clerk, and by him sent to the commercial accountant, who fills in prices and sends forms 22 to the bill clerks.

Form 23. Yellow paper. Printed all in red. Size, 8 by 7¼

WELLS BROS. CO.				Form 25.	
NAME OF MACHINE _____					
Pattern Number	DESCRIPTION.	Where	Number Used	Kind of Pattern	

FORM 25. PATTERN RECORD. SMALL SIZE.

inches. Goods-retained credit form, filled by the commercial accountant, and sent to creditor.

Form 24. Heavy white paper. Ruled in red and blue and printed in black on both sides. Pattern record, tracing sheet and pattern inventory.

The Wells Brothers Company has a very large list of patterns, many of metal, gated or sprayed, and many machine-part patterns of wood. Patterns commonly take a symbol composed of a letter and a number. Patterns are stored on shelves, all on one shelf being entered on forms 24, in manuscript duplicate, one copy hung on shelf where patterns are stored, and one copy placed in a card-indexed filing tray kept by the factory superintendent.

Form 26, Order For		Ticket No. _____																																	
Date _____																																			
Name	Job	No. Hours								Price Per Hr.	Total Hrs.																								
	Drafting																																		
	Pattern																																		
	Milling																																		
	Drill																																		
	Lathe																																		
	Planer																																		
	Fitting																																		
Total Hours _____																																			
<div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <p>Machinery Steel _____ Lbs.</p> <p>Tool Steel _____ Lbs.</p> <p>Wrought Iron _____ Lbs.</p> <p>Babbitt _____ Lbs.</p> <p>Castings _____ Lbs.</p> </div> <div style="width: 30%; text-align: center;"> <table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <th style="padding: 2px;">Screws</th> <th style="padding: 2px;">Size</th> <th style="padding: 2px;">Number</th> </tr> <tr><td style="padding: 2px;">Hex. Hd.</td><td></td><td></td></tr> <tr><td style="padding: 2px;">Flt. Hd.</td><td></td><td></td></tr> <tr><td style="padding: 2px;">Set</td><td></td><td></td></tr> <tr><td style="padding: 2px;">Spline</td><td></td><td></td></tr> <tr><td style="padding: 2px;">Gib</td><td></td><td></td></tr> <tr><td style="padding: 2px;">Taper Pins</td><td></td><td></td></tr> <tr><td style="padding: 2px;">Lag</td><td></td><td></td></tr> </table> </div> <div style="width: 30%;"> <p>Cost of Material _____</p> <p>Cost of Labor _____</p> <p>Total Cost _____</p> <p>Charges on Previous Tickets _____</p> </div> </div>												Screws	Size	Number	Hex. Hd.			Flt. Hd.			Set			Spline			Gib			Taper Pins			Lag		
Screws	Size	Number																																	
Hex. Hd.																																			
Flt. Hd.																																			
Set																																			
Spline																																			
Gib																																			
Taper Pins																																			
Lag																																			

"No. used" column spaces tell the number of pieces wanted for one of the productions to which the pattern belongs. The "Where" column gives the location of any pattern removed from the shelf where the card is placed. The "When ordered and how many" space at the extreme right was intended to record orders for castings, but is not much used.

The card-indexed file kept by the superintendent is expected to correspond with the record of the shelf cards.

Form 25. White card. Ruled in red, blue and black. Printed in black. Size, 4 15-16 by 3 inches. Pattern-record card, small size. This form is not yet in use, but is to take the place of form 24. Form 25 contains less information than form 24, but is of more convenient size, and is expected to be satisfactory. It will have the same uses and lodgements as form 24.

Form 26. Stiff manila card. Printed in all black. Size, when folded in folio, 5 13-16 inches long by $3\frac{7}{8}$ inches high. Special production order, with material and labor hour spaces for collective cost records. This form is used for special tool production.

If the space blanks of a single form 26 do not give room for all the charges to one construction, then other forms are filled for the same order number, enough forms 26, consecutively numbered, being used to record the entire order cost. Since form 26 is used for special constructions only, it meets all requirements. The president of the Wells Brothers Company is acting cost-keeper, as well as factory superintendent, and fills and files forms 26, which fold in the middle to fit card-cabinet boxes.

This form has been changed many times, and is now regarded as satisfactory.

Running costs on a special tool which may require changes and additions, are easily kept by use of form 26, totals being carried forward on successive cards as the work proceeds.

The Wells Brothers Company has experimental work constantly in progress, and the costs of this work are gathered in forms 26 and 27, which are regarded as highly satisfactory for productions which are uncertain, as experimental work and new shop tools must always be.

Form 27. Thin manila paper. Printed in black. Size, $7\frac{1}{2}$ inches long by $8\frac{1}{2}$ inches high. Weekly time and production-

Form 27

KEEP THIS TICKET CLEAN AND STRAIGHT.

TIME AND PAY TICKET FOR THE WEEK ENDING SATURDAY, _____

NAME _____

FACTORY NO. 1 _____

Day of Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total Hours Work	Price per Day	Total
Hours Work by the Day									
Hours Piece Work									
MONDAY	NUMBER OF JOB		NO. PIECES		FOR WHAT MACHINE OR DESCRIPTION OF DAY WORK.				
SATURDAY									

Be particular to put **NUMBER OF JOB** on ticket.

Total Pay for the Week, \$ _____

Return this Ticket **MONDAY** morning with all the work of the week upon, clean and plain.

FORM 27. WEEKLY TIME AND PRODUCTION RECORD.

The original has spaces for Tuesday, Wednesday, Thursday and Friday, similar to those shown for Monday and Saturday.

record card. Used to collect production and time items relating to work done by either day rates or piece rates. The hardening and the tempering are done in this factory at day rates, thus avoiding all temptation of workmen to hurried operations.

Forms 27 are filled by the workman, and sent first to the paymaster, and then to the factory superintendent for consideration, and by him filed so long as they are of interest.

The Wells Brothers Company's form blanks are, as a whole, marked by an exact adaptation to meeting the difficult conditions of a business which must be transacted promptly, and at the same time must submit to sudden and unforeseen changes.

The product is of the most exacting nature, as it must not only be very nearly perfect in form, but must have good cutting edges and great strength. The inspection must be rigid and thorough, and severe physical tests are applied to the finished product to ensure its resistance to torsion. A vast number of taps are broken in the twisting test, which is far more severe than careful usage would ever inflict.

The forms must be flexible in every way, so as to meet the unexpected, which is a part of the daily certainties of this establishment. Forms 16 and 17 are believed to be unique, and they certainly fill their purposes admirably.

CHAPTER IX.

THE C. W. HUNT COMPANY, WEST NEW BRIGHTON, NEW YORK.

The Hunt Company's offices are on the west side of a north-and-south street of West New Brighton, Staten Island, with the drawing room, occupied by the executive engineer, the preliminary engineer, the draftsmen, the order superintendent, the purchase agent and the sales-order clerk, adjoining to the south. The "publication office" is in a separate building, still to the south, and on the same side of the street is a store yard for narrow-gauge railway track made up with pressed-steel ties, ready for shipment. The factory consists of a number of single-floor structures, and one building having a second floor, occupied as a pattern shop above, and carpenter shop below. The power house contains the steam engine, air compressors and dynamos, the power being almost entirely transformed into electric current and most of the machine tools being driven by independent electric motors belted to the driving pulleys in many cases by very short belts, which are preferred to any form of chain drive.

A narrow-gauge railway of the company's own pattern, operated with Hunt electric locomotives, penetrates the works in all directions, and leads north, down the street between the offices and the factory to the dock, where much bulky finished product is stored, and where the rope stores, handled by the rope clerk, are kept on the ground floor of the dock storehouse. The factory has separate offices for the factory accountant, the works superintendent, the storekeeper, in charge of the rough stores, the telephone office of the works, the warehouseman, and the "Box Office," occupied by the box clerk, who keeps the boxes, and the stores-card index ledgers.

Two entirely different manufactures are carried on, one of electric locomotives and steam hoisting engines, and the other of plate and rail work.

The workmen are paid at day, piece and premium rates. No inside workman makes any record, all factory time cards being filled by the foreman. Time recorders are used throughout the place.

The C. W. Hunt Company's business is wholly founded on the patented inventions of Mr. C. W. Hunt, who was educated for the profession of civil engineer, by accident became a coal dealer early in life, and at once, perceiving the need of machinery for the cheap and convenient handling of coal and ore, which at that time was unknown, began his series of most successful productions for that purpose with his automatic, traveling, coal-handling-and-storing machines, which he made so perfect at the first attempt that they are the standard appliances of to-day.

The coal-and-ore-handling installations involve the use of a vast assemblage of repetition details, in connection with supporting structures of considerable magnitude which must be original creations, each designed especially to suit the conditions of its location, it being rarely the case that exact duplications of previous structures are perfectly suitable for a new plant. These conditions force the Hunt Company to combine in an unusual degree repetitions and original creations, and call for a high order of engineering and executive ability, combined with the closest attention to producing, storing and shipping the repetition product of the factory, and have led to the use of a very full list of printed forms, and to some unusual expedients in the way of handling correspondence and related papers, in the form of stores-ledger used in the "box office," in the position of box clerk, in the peculiar apportionment of duties to the warehouseman, and in the establishment of the rope keeper.

The C. W. Hunt Company's forms comprise a very full list of blanks made to meet all the requirements of an extended business, employing workmen in various parts of the United States and Europe in erection, and working about 300 hands in the company's shops, West New Brighton, Staten Island. Many travelers are engaged in the business, which may be said to be world-wide, dealing mainly in machinery for handling coal and ore, electric locomotives and narrow-gauge railway track, made up of light rail riveted to pressed sheet-steel ties. These locomotives, tracks, coal buckets, operating automatically, and the towers, jibs and

steam and electric hoisting engines which are required by the comprehensive material-handling plants erected by this company, form the principal items of its product. The factory at West New Brighton produces all the machinery and appliances: Track, cars, hoisting engines, electric locomotives, coal buckets and so on. Heavy structural steel work is contracted for wherever it can be best done.

The general scheme of operations at West New Brighton is to operate the Hunt Manufacturing Company as an independent concern, selling its entire product to the C. W. Hunt Company at factory cost. The West New Brighton works are divided into departments under authority as specified on forms 7 and 13, and by the charts. The commercial system was founded on deductions from the work of the well-known English authority on factory management, Mr. J. Slater Lewis; the works forms now in use are mainly original with the C. W. Hunt Company.

The "box" form of stores ledger or inventory is a conception of Mr. C. W. Hunt; it was at first made to keep the complete rough and finished stores record of all receipts, disbursements and stores on hand. At present a card index has replaced many of the boxes, but 750 items have their stores history yet contained in the 750 boxes remaining in the rack in the "Box Office," as the stores-ledger keeper's office in this works was named, from this use of boxes and slips for keeping the stores record. See forms 50, 51, 52 and 53 and Fig. 49 for a full exposition of this novel stores ledger, which is believed to be more quickly manipulated than a card index, for such items as have a great variety of lengths and diameters, as bolts, screws, cotter pins, chain and the like.

Besides this peculiar stores ledger, the distinctive characteristics of the Hunt Company's factory practice are a peculiar manner of indicating dimensions on the drawings, a peculiar method of making measurements of work in progress, and special designs of combined machine tools of large size, by which this peculiar method of making work measurements can be carried out. A large planer having a heavy vertical drilling-and-boring spindle carried by a saddle sliding on the long planer cross-rail, and a large boring mill, having a boring spindle of usual construction in one of its cross-rail saddles, a vertically-acting slotting ram carried by another saddle sliding on the same cross-rail, and yet

a third saddle carrying a drilling spindle, supported and traveling also on the boring mill cross-rail, permit unusual and highly economical effects in finishing planed, bored and turned pieces of considerable size, and also the accurate location of holes and planed surfaces with relation to each other without the use of jigs or templets, by the "datum line" measurement system mentioned, and peculiar measuring abutments attached to the machine tools themselves, which are used in connection with steel measuring rods of fixed lengths.

THE HUNT COMPANY'S SYSTEM CHARTS.

The Hunt Manufacturing Company's ranking of authorities and the factory routine are given on the six "System Charts," 18 inches long by 11½ inches wide, the regular "unit" detail drawing sheet size of this factory, which are here shown on a reduced scale.

Diagrams of chemical relations, combinations and reactions have been long used, in which bodies or substances are represented by circles, and actions by lines connecting them, and Mr. J. Slater Lewis employed the same symbols in the construction of factory accounting charts, but so far as known these C. W. Hunt Company charts are the first in which circles and lines are used to show a complex factory organization in this manner, and they are therefore described at some length. It is believed that the rank and functions of officials, their mutual relations and the factory routine can be more comprehensively and clearly exhibited by charts of this description, than by any printed paper, and these novel diagrams certainly merit close attention.

The general scheme of this "System Chart" construction, which is the work of Mr. John Calder, the executive engineer, is to represent both individuals and things by circles containing identifying titles, and to so locate these agency circles on the chart sheet as to enable them to be connected by lines of influence, action, association and control, so as to clearly indicate the general and specific relations of one to another, and where important, the precise functions of individuals. Arrow heads in the connecting lines show the direction of the communication, influence or product, passing from one agent to another. If the arrow heads point both ways in the same com-

munication line between two circles, then the specified communications pass both ways. If the arrow heads in a line point one way only, then productive communication is in that one direction only. So far as possible the superior agent circle is located on the chart sheet above the circle representing the subordinate agency, and explanatory notes are sometimes inscribed along the lines and adjacent to the circles. A careful study of these elaborate charts will enable the student to experiment with this novel graphic form of factory organization exhibit, which can be made to very clearly and forcibly express the relations of the productive agencies, which actuate and control the related functions of the factory.

The agencies specified on these charts as instrumental in factory production are the customer, the outside salesman and the manager of the sales department, which three factors suffice to bring orders for standard product to the factory.

To these three factors the preliminary engineer is added in case of new conditions to be met, and he produces the preliminary drawings and layouts, with the aid of official consultation and his force of preliminary draftsmen. Through the secretary the preliminary drawings and estimates go to the inquirer, and if an order results, it is sent by the secretary to the order clerk, and through him to the executive engineer, who, in consultation with the works superintendent, directs the chief draftsman and the working force of the drawing room in the preparation of the drawings, the bills of material, in which every order component is specifically described, and the piece-tags which are attached by the storekeeper to material sent by him into the factory.

The copies of bills of material, and blue prints and the related piece-tags are collected by the order superintendent and by him sent to the works superintendent, who sends copies of the bills of material to the works foreman, to the box office, and to the storekeeper, with the piece tags.

Finished work is collected and stored and shipped to the customer by the warehouseman, who is the route clerk, as well as the shipping clerk.

Sales orders for regular factory product of standard merchandise, are produced by the same factory routine, but do not, of course, require the services of the preliminary engineer.

The "stevedore" specially treated manila rope is handled in such quantities as to constitute a sales department by itself. All other sales fall in the regular production and shipment routine, as described.

This makes a perfectly elastic system. The sales order may be for a single item of regular product, which can be shipped by the warehouseman immediately, or it may demand original engineering in the creation of the preliminary drawings, and months of time in the drawing room and factory after the order is given. In the latter case the executive engineer prepares Schedule 1, general queries and memoranda, Schedule 2, general time-table, Schedule 3, drawing room time-table, and Schedule 4, the required material purchase list.

Thus, the factory productive and cost-keeping agents are the executive engineer, the chief and subordinate draftsmen; the drawing room librarian, who records, files and delivers drawings and prints; the order superintendent who sends the bills of material and piece tags and blue prints to the works superintendent; the box clerk who keeps the rough-stores ledger and records the weights on the bills of material; the storekeeper who attaches the piece tags to the material and sends it to the first-operation department of the factory; the warehouseman who collects and ships the finished product; and the factory accountant.

Purchases are made by the purchase agent, and received by the storekeeper, who checks invoices of materials received, except "stevedore" rope, and thus fills the two places of rough stores keeper and receiving clerk.

Costs are kept by the factory accountant, who also makes up the pay roll from time clock card records, checked by the workmen's time cards which are filled by the department foreman, and are first sorted to the workmen's names, and then to the order numbers. Finished components go to the inspector, who tags all assembled product with his inspection certification tag, and all piece tags go to the factory accountant, who obtains item and gross order material weights and costs from the bills of material and the piece tag records, the factory prices being entered on the sales order by the factory accountant, and the invoice price being determined by the commercial accountant of the Hunt Company.

This general exposition of the factory production costing,

storing and shipment, and mention of production officials and their distinguishing functions, will aid the observer in the study of the six Hunt Company system charts, described as follows:

System Chart No. 1. General Organization. The customer, the purchaser of the factory product, without whom the factory could not exist, is placed in the superior position on chart 1, directly over the secretary of the sales department of the factory, and the highest line of action on the diagram represents the sending, by the controller, of the company's bill for merchandise sold, to the customer, thus fully recognizing by chart positions the absolute subordination of the factory to the purchaser of its product. Communications pass both ways between the traveling salesman and the customer, and between the sales department and the customer as shown by the vertical line with both-way arrow-heads, left, while the vertical line, right, indicates the passage of the customer's order to the sales department, this line having but a single arrow head, directed from the customer to the factory. "Other officers" communicate with the sales department, and intercourse is carried on both ways between the president, or "Head" of the factory and the sales department, from the estimate clerk, to the chief clerk, who has charge of the correspondence and of the "case" and "form B" (see the Hunt Company's form 10), and to and from the preliminary engineer, all as indicated by circles and lines to the right of the customer and sales circles. The preliminary engineer communicates with the Head, and the estimator, executive engineer, other officers, master mechanic, sub-contractors and outside supplier, as indicated by the horizontal line from the preliminary engineer and the six circles depending therefrom, and also instructs the preliminary draftsmen as shown by the vertical line, who produce and send out, first, the preliminary drawings and lay-out of the scheme, as shown by lines and notes on their left, and, secondly, the working drawings bearing the customer's order number, as shown by lines to the right of the draftsmen's circle. The master mechanic issues orders to the erectors, as shown at the right of the draftsmen's vertical line.

An inclined line leading left from the sales circle to the executive engineer circle indicates the passage of the "case" and the sales order (Hunt Company's form 54), from sales to the executive engineer, who prepares, in case the order is large, schedule 1,

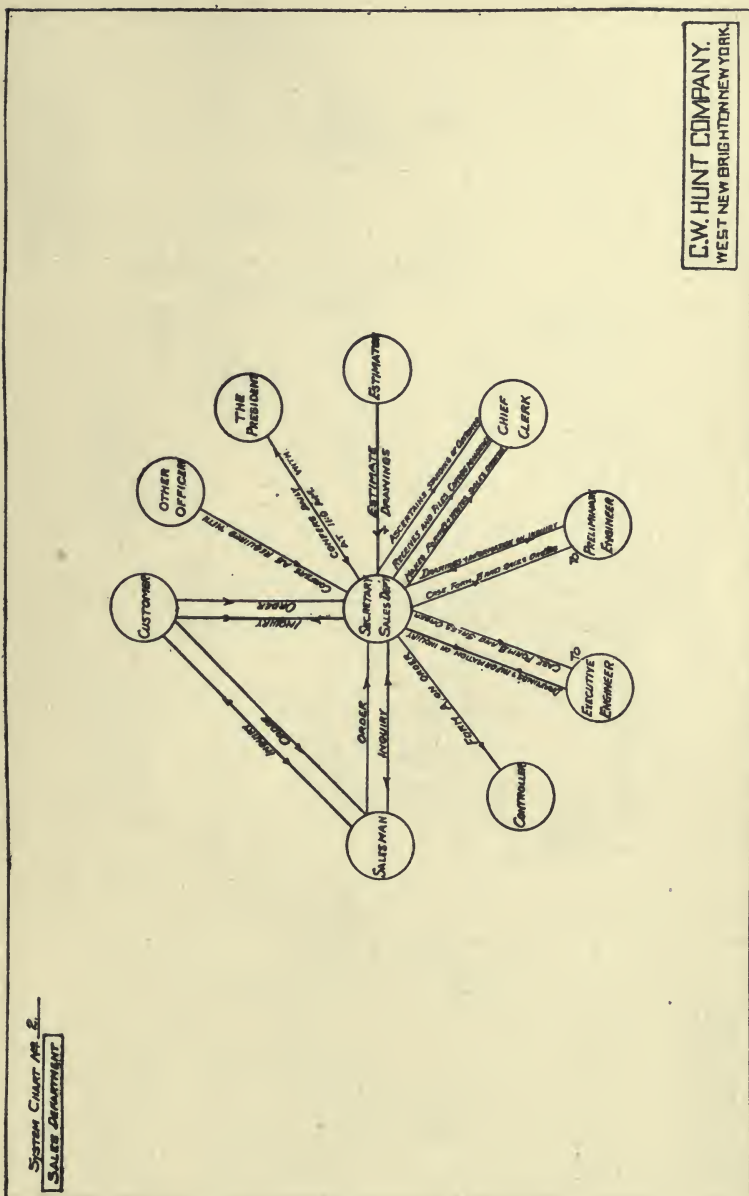
memoranda and queries, the "time-table" at large, the drawing-room time-table, and the material purchase list. The executive engineer communicates with the eleven departments below; these circles begin with the Head and end with the inspector, including "other officers;" preliminary engineer; works superintendent; estimator; chief draftsman, who issues drawing-office orders to draftsmen; librarian, in charge of drawings and prints; master mechanic; department of tests; and the award committee. The executive engineer is shown as immediately superior to the order superintendent, whose duties are purely clerical, and comprise filling of forms 56 from forms 54, and the placing of the bills of material, the piece tags and the related blue prints in stout manila envelopes, numbered with the order number to which the enclosures relate, sending these envelopes to the works superintendent, and sending forms 54 and 56 to the warehouseman, who is the finished-stores keeper, and makes all shipments and finished-stores disbursements. It will be observed that for the sake of clearness the warehouseman circle appears in two locations; in the upper position the warehouseman is shown as receiving two forms of communications from the order superintendent, as conveying supplies from the outside supplier circle to the storekeeper, and to the works superintendent, the outside supply being furnished from orders by the purchase agent, as directed by the order superintendent or the works superintendent. From this upper warehouseman's circle there is no line of communication to the controller, which is a line of vital importance. From the lower warehouseman's circle, at lower left of this chart No. 1, the line of "Notification of Shipment" rises to the controller, also a line of communication from the warehouseman to the works superintendent, and a vertical line with a bracket which includes all the factory-department circles, with its arrow head towards the warehouseman, showing that the whole factory production goes to the warehouseman; while an indeterminate horizontal line, arrow flight away from the warehouseman's circle, indicates the product shipment function of the warehouseman. The works superintendent is shown as superior to, and directing, all factory departments, and as receiving communications from the inspector and from the factory accountant, and as exchanging communications with the storekeeper, who is shown as controlling patterns, castings, forg-

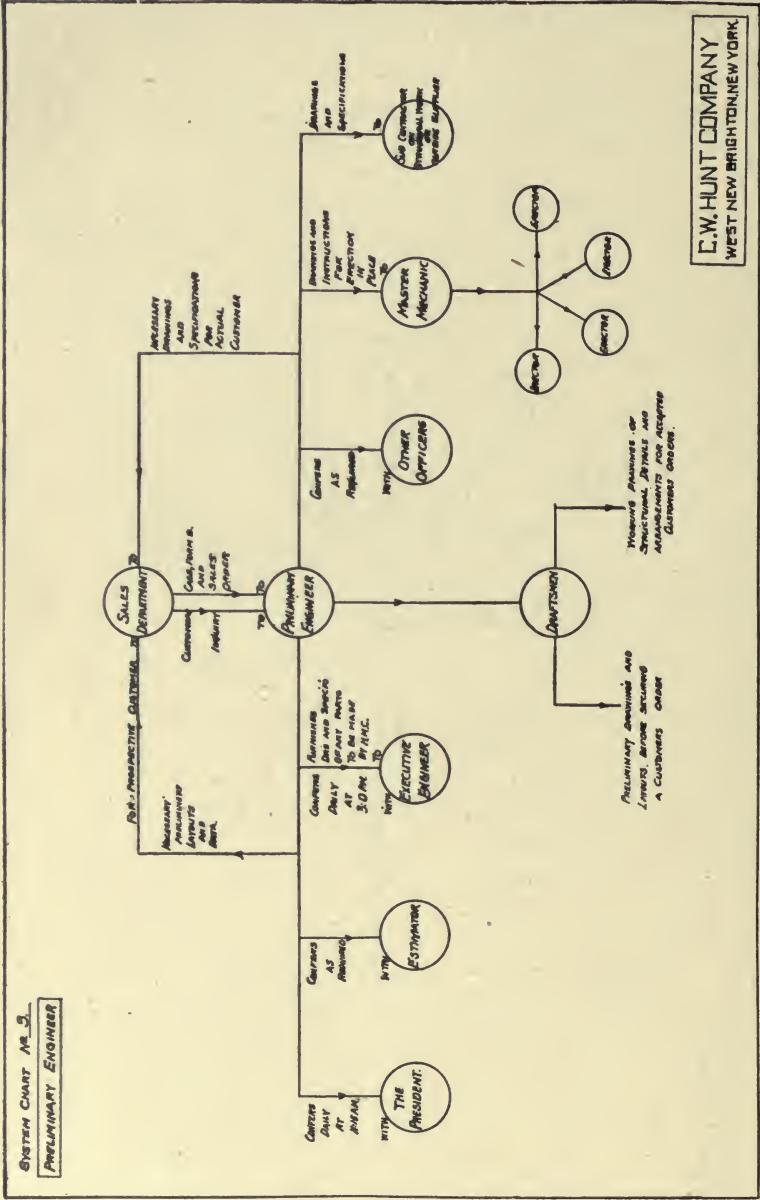
ings, wrought stock, lumber and miscellaneous stores. The "Weekly Conference" circle shows by its lines of action and arrow heads and inscription, that it exchanges communications with the works superintendent, and is attended by all the department foremen, and sends its communications upward to the executive engineer.

The reader who has followed this interpretation of chart No. 1 sign writing so far, will now perceive that close attention must be given to form and location in the construction of similar cryptograms, and that the arrow heads are highly significant, and that the lines of communication are most important. The small semi-circle used where lines must cross each other adds much to the clearness of indication. This chart No. 1 is comprehensive, and clearly shows the relative positions of officials by the grouping of the circles. Thus, in case of the works superintendent, the scope of his influence is seen at a glance to include the purchase agent, storekeeper, and, through the storekeeper, the rough stores and all factory departments; and it is also seen that the works superintendent is the immediate superior of the plant engineer, who sends him information collected from the electrical engineer, shops and machinery, power house and the office building.

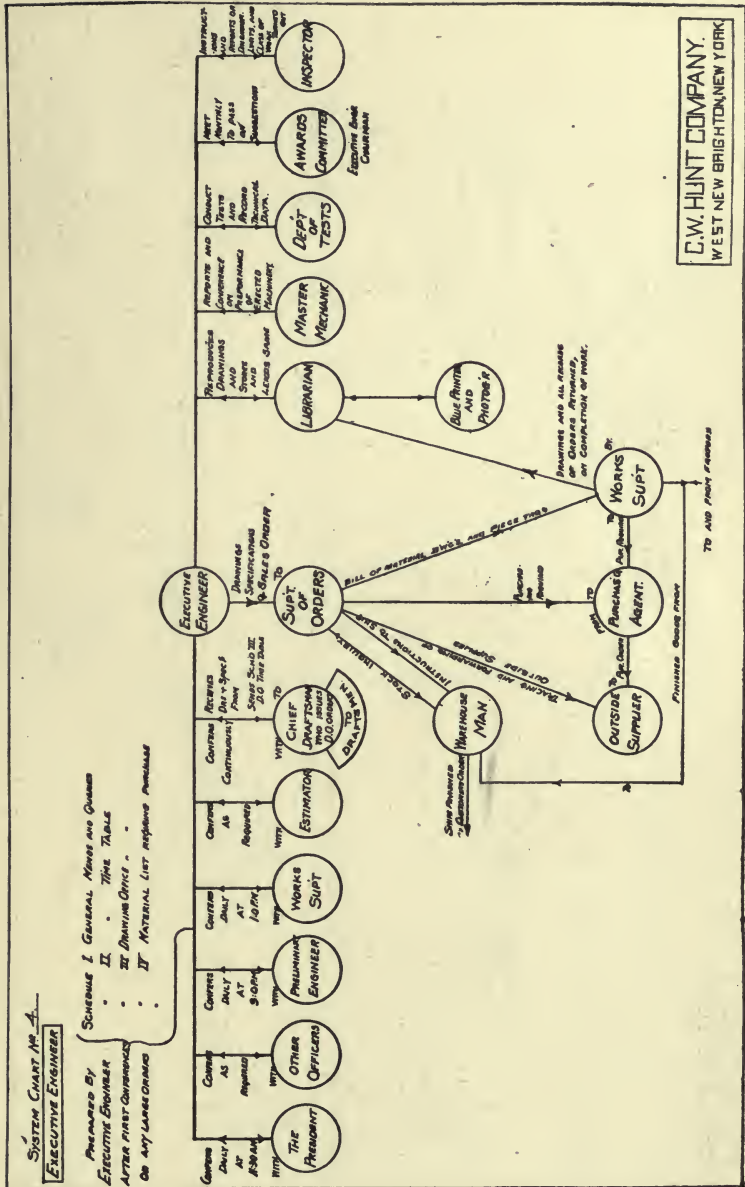
System Chart No. 2 exhibits, in detail, the duties, functions and responsibilities of the secretary of the company, who manages the sales department, answers inquiries, confers with other officials, meets the Head daily at 11 A. M., receives estimates and drawings from the estimator, and is the superior of the chief clerk, who rates credits, is correspondence clerk, makes up the "case" files and sends sales orders to the sales agent. The preliminary engineer produces the preliminary drawings in response to inquiries, and makes up the "case," "form B," and the sales order particulars, in consultation with the executive engineer. The secretary notifies the controller as to orders obtained, and exchanges communications with the salesmen, who are in communication with customers. Orders come to the secretary from both salesmen and customers.

System Chart No. 3 gives an extended detail of the duties, functions and authority of the preliminary engineer, and will be fully comprehended by the reader who has attentively perused

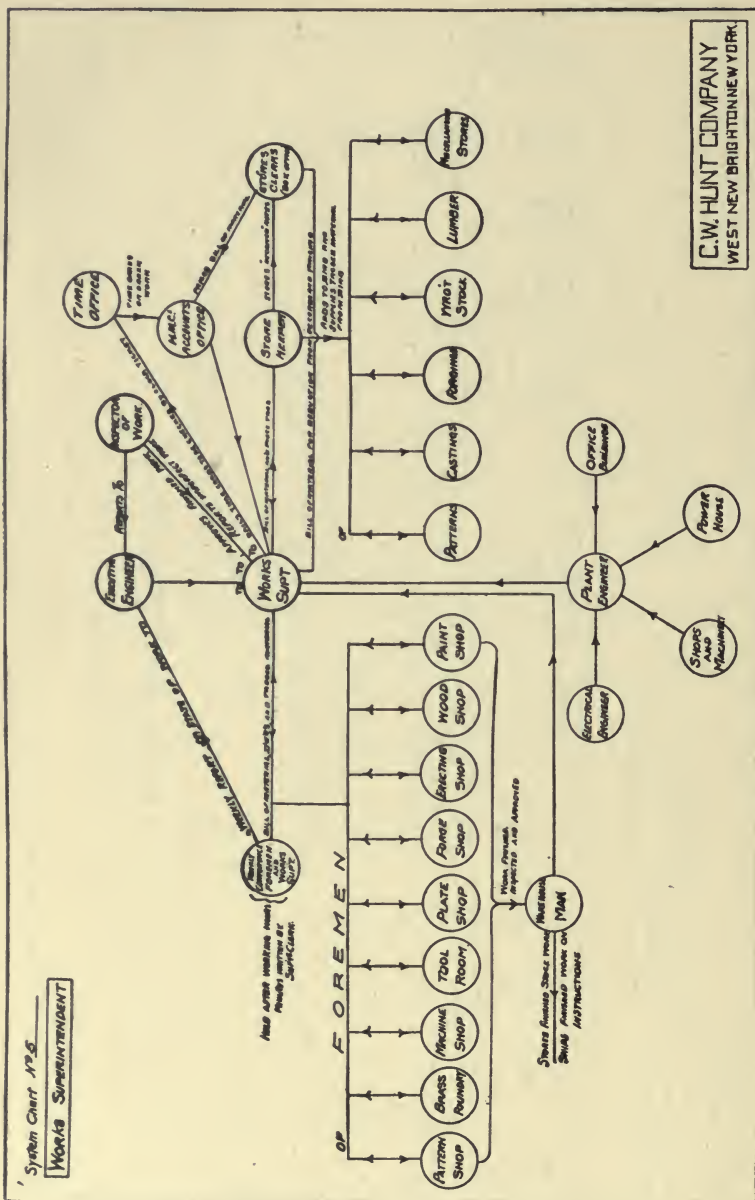


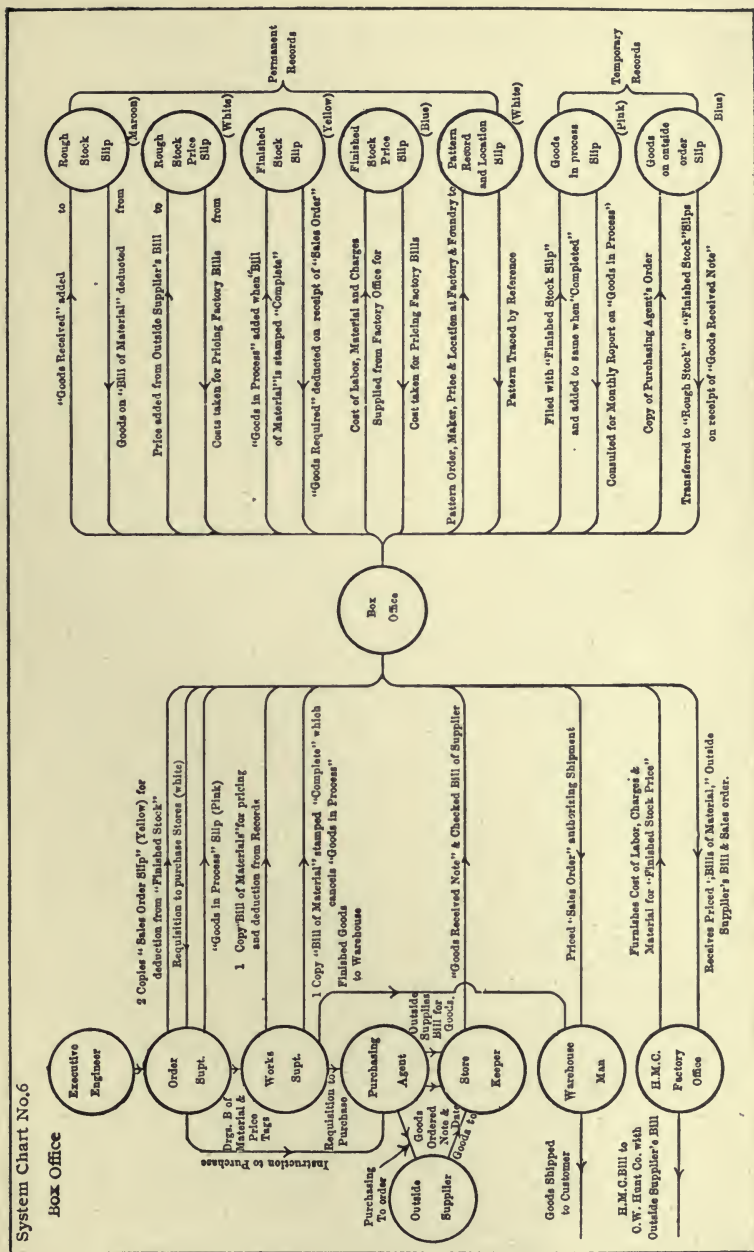


SYSTEM CHART 3. PRELIMINARY ENGINEER.



SYSTEM CHART 4. EXECUTIVE ENGINEER.





the translations of the previous charts, without particulars of explanation.

System Chart No. 4 gives a like detail of the functions and performance of the executive engineer.

System Chart No. 5 gives a detail of the duties, authority and functions of the works superintendent, and will be readily comprehended without special interpretation in this text.

System Chart No. 6 gives a detailed view of the "Box Office" method of procedure.

To minds trained in the use of drawings and diagrams generally, or to factory officials accustomed to the use of graphic expositions of accounting systems, charts such as here shown afford a compact and comprehensive means of conveying information, and of exhibiting the details of factory relation, authority and routine in an impressive manner, by combinations of graphic symbols and literal inscriptions as employed in these ingenious original examples of factory function chartography.

Other minds, unfamiliar with both diagrams at large and these highly specialized creations, may be inclined to doubt their clearness at first sight. But the factory manager who has endeavored to produce a written detail of factory routine and authority, so simple and lucid as to be at once fully comprehended by all who should be perfectly familiar with the entire practice of the establishment, will be likely to find this chart system of conveying information advancing in his estimation as he studies it. The writer may say here, that he has never yet found in any factory an errorless written story of the authority and routine combined, and that it is extremely rare to find any one official of a factory who knows the entire routine of the form handling. It is the rule to find each official familiar with his own manipulation of the forms which he himself handles, and no more. It is undoubtedly desirable that every factory officer should have a clear general idea of the meaning of the factory system at large and in detail, and Mr. Calder's charts appear to be distinctly helpful in this direction.

THE ROPE KEEPER.

Manila "Stevedore" rope, laid up in a plumbago and tallow composition, as patented by C. W. Hunt, for reducing friction, is largely handled. Rope is stored in a rope storehouse on the dock,

in charge of the rope keeper, who has an office by himself in the main office building, and keeps a card ledger of the rope stores, and makes his own replenishment requisitions, using the regular Hunt Manufacturing Co.'s purchase forms and routine for ordering and placing replenishments in the rope stores.

The rope keeper, through his rope clerk, delivers rope to the warehouseman, who makes all shipments to customers, on customers' orders, which are kept by the rope keeper on the "case" system in his office. (See form 10). To satisfy a customer's order the rope keeper fills three forms RA, two white and one green, all three with the same serial number, in carbon triplicate, the white original remaining in the rope keeper's book, and the duplicate and triplicate being sent to the order superintendent, who sends the white duplicate to the warehouseman and the green triplicate to the factory accountant. The warehouseman fills a manila envelope shipping tag, form RB, with the coil number and length, and the order number, and sends it with the white duplicate form to the rope stores clerk, who cuts and delivers the rope to satisfy, and fills the delivery spaces in the rubber hand-stamp form RD, on the back, and delivers the duplicate form RA, and the satisfaction, with the tag attached, to the warehouseman, who makes the shipment after filling the weight space on the back and the shipment certification space, and advises the consignee by letter as in case of all other shipments, and sends the white duplicate form RA to the bill clerk, who makes the invoice and returns duplicate form RA to the rope keeper, who then makes his stores-ledger card entry of the stores disbursement on his form RC.

The rope clerk keeps a similar rope ledger RC, on which the customer's name, coil number, length and order number are entered for each delivery of rope to the warehouseman.

Two card ledger records of the rope stores are kept, made on stiff manila cards, taken from a rope-purchase stub book, the stub and two cards being separated on lines of perforation, the stub and the two ledger cards forming an original rope-purchase book page, and all three forms bearing the same serial number. The stub remains in the coil-purchase book, which thus contains a coil record of all rope stores replenishments. The RC form bearing the word "coil" goes to the rope clerk, who keeps it with the related coil until exhausted. The "office" RC form is kept by

the rope keeper on his desk, deductions being made by him as sales are recorded.

The amplification of detail and the record duplication shown in this account of rope-handling routine is shown in many other functions of the Hunt factory, where clerical labor is not spared in the making of record entries.

The green triplicate form RA is sent by the order superintendent to the factory accountant, as specified, for the purpose of crediting the factory with the disbursement labor only, the rope-stores purchase expenditure not appearing as a charge against the Hunt Manufacturing Company.

This installation of a sales department exercising individual functions, and virtually acting as an independent agent, is interesting, as it is enabled, by passing form RA through the hands of the order superintendent and the warehouseman, to bring its performance into the factory sales routine, and at the same time to maintain an entirely distinct organization of its own without the slightest confusion or crossing of lines of authority.

Since the rope department is a thing by itself, its forms will be here described.

ROPE FORMS.

Form RA. White paper. Red, blue and black ruling. Printed in black. Size, 7 inches long by $9\frac{1}{4}$ inches high.

Furnished in triplicate pad book, two white sheets and one green sheet bearing the same serial number, one white sheet unperforated, and one white sheet and one green sheet, of the same number, being perforated to separate at left hand. This book is kept on the rope keeper's desk. The forms are filled on receipt of the customer's order by the rope keeper in manuscript triplicate, two white and one green sheet, one white sheet remaining in the book as the rope keeper's record, and the white duplicate sheet being sent to the warehouseman, while the green triplicate sheet is sent to the factory accountant. The white duplicate has a red ink rubber stamp impression, applied to the upper left corner of the back of the sheet by the rope keeper, constituting form RD, and reading as follows, each phrase on a separate line:

"Shipped via.... Date.... Selected by.... Packed by....
Shipped by.... No. of Packages.... Description of goods...."

Lower down on this form are stamped the words:

"Weight. . . . Certified as to shipment. . . ."

The back spaces are filled by the rope clerk, and by the warehouseman, who is the route clerk and shipping clerk.

Form RB. Manila envelope, with shipping-tag grummet. Black print and ruling. Size, 6 inches long by $3\frac{3}{8}$ inches high.

Filled by warehouseman and sent to rope clerk, who attaches form RB to the order satisfaction. The envelope contains an enclosure relating to the particular merchandise tagged by it.

Form RC. Stiff manila card. Blue serial number. Black print. Size, $3\frac{1}{4}$ inches long by $5\frac{1}{8}$ inches high.

This is part of a page of the rope-stores replenishment book, kept by the rope keeper. Each page consists of a stub, an "office" card and a "coil" card, the same as the "office" card shown, except the word "coil" in place of "office." The stub and both cards bear the same serial number, and all are filled with the coil description by the rope keeper when the coil is sent to the rope stores. The "coil" ledger card is kept by the rope clerk, who notes the name of the purchaser and the number of feet for each order.

The rope keeper keeps form RC, "office," on his desk, and makes deductions of sales from the coil card. By the use of these forms an account is kept with each coil of rope purchased.

TRAVELERS', CALLERS', AND CORRESPONDENCE FORMS.

Forms of this nature are numbered from 1 to 13 inclusive, and, with the exception of form 10, show no unusual features. The sheets used are of ample size, and the inscriptions are in all cases explicit. These forms for the purposes of this book have been given the following numbers and names:

- No. 1. Caller's Slip.
- No. 2. Telephone Message Record.
- No. 3. Filing Directions. Correspondence.
- No. 4. Letter Sheet Form to Salesman.
- No. 5. Quotation.
- No. 6. Acknowledgment of Order.
- No. 7. List of Departmental Authorities and Addresses.
- No. 8. Outside Agents' Daily Report.
- No. 9. Outside Agents' Expense Report. Front.
- No. 10. "Case" Back.

- No. 11. Decision Deferred Form.
- No. 12. Departmental "Case" Inquiry.
- No. 13. Departmental Communication Envelope.

Form 1. Caller's slip. Same as the Cottrell caller's slip, which see.

Form 2. Telephone message record blank. Printed in purple ink on thin white paper. Size, 8¾ inches long by 5½ inches high.

Form 2

TELEPHONE MESSAGE.

C. W. HUNT COMPANY, 45 BROADWAY, N. Y.

TIME _____

DATE _____

REGISTERED No. _____

CASE NO. _____

From _____

To _____

Sent by _____

Received by _____

Signed _____

FORM 2. TELEPHONE MESSAGE RECORD.

Form 3. Filing Directions. See correspondence. Paster. White paper. Black print. Size, 3¾ inches long by 2½ inches high. Inscribed as follows:

- Case.....
- Follow by.....
- About.....

Form 4. Travelers' Letter Sheet. White paper. Size, 8¾ inches long by 10¾ inches high. Printed in black, as follows:

C. W. HUNT COMPANY.
Date.....190
Case.....

Mr.....
.....

Dear Sir:

Herewith is a copy of a communication from.....
[full address.]

Please place this case on your list and give it proper attention and report fully to this office, returning above copy with your report.

When returning this form please insert a date in the notation, at the bottom of the page, for future action as your judgment dictates.

In your report state fully why and when the case should be revived, chased by letter or called upon. Yours truly,

C. W. HUNT COMPANY,
 Secretary.

WA. Chase at this date or call upon them and report fully.

WB. Examine and decide what course to pursue at the date given.

WC. Lost business unless heard from on date given.

WD. Waiting for our action. Salesman to report or take the case up.

FORM 5 REGISTER No. _____ CASE No. _____ DETAIL No. _____ DRAWING No. _____	<h2 style="margin: 0;">QUOTATION.</h2>	FROM C. W. HUNT COMPANY, NEW YORK
West New Brighton, _____ 190____		
We beg to quote you the following prices, subject to change without notice:		
To accompany our letter of even date.	Above prices F. O. B. at our Works, New York.	
Shipment can be made in about _____	Terms of payment, _____	
Goods at your risk after delivery in good order to the Transportation Company.		
C. W. HUNT COMPANY. _____		

Form 5. Quotation. White paper. Printed in blue. Size, $8\frac{3}{8}$ inches long by 6 inches high.

This is the small size form, same size in green paper. Large size $8\frac{3}{8}$ inches long by $10\frac{3}{8}$ inches high, single sheet, and $10\frac{3}{8}$ inches high, folio, on both white and green sheets. These sheets are with variations, as, "We beg to quote you following prices, subject to change without notice."

Estimates are under a similar heading, with word "Estimate" in place of "Quotation," and have the reservation, "We have estimated the cost of the following articles, subject to our usual contract clauses relating to fire, strikes, delivery, permits, payments, etc.," above the items.

Form 6. Acknowledgment of Order. Pale blue paper. Purple print. Size, $5\frac{1}{2}$ inches long by $8\frac{1}{2}$ inches high. Not engraved.

Form 7. List of Departmental Authorities and Addresses. White. Printed in black. Size, $4\frac{7}{8}$ inches long by $3\frac{7}{8}$ inches high. See form 13 for this list.

This address slip is clipped to any document with a wire spring clip, and ticked with a pencil mark at delivery address.

<p>NOTE—A daily report must be made on this form of every place visited and conversation held relating to the company's business. A separate report must be made out for each separate case or customer, recording fully all data ascertained in relation to it, for filing on the case in the home office.</p>	<p>Daily Report of _____ At _____ Date _____ Subject _____ Case No. _____</p>
<p>C. W. HUNT COMPANY West New Brighton, New York. <i>GENTLEMEN:</i></p>	

FORM 8. DAILY REPORT OF OUTSIDE AGENT.

Only the upper part is shown. There are 22 blank horizontal lines on the original.

The receiver erases the pencil tick, and uses the address slip and wire clip over again. All foremen and officials are supplied with these slips, which secure legibility of address.

Form 8. Daily Report of Outside Agent. Letter head. Black print on white paper. Single sheet. Size, $8\frac{3}{8}$ inches long by $10\frac{7}{8}$ inches high.

Form 9

~~Sing. Ed. Co. N.Y.~~

C. W. HUNT COMPANY,
TRAVELING EXPENSES.

Folio _____

Name of Salesman, Engineer or Official, _____

For week Commencing _____ Ending _____

DAYS.	To.	From.	Traveling.	Maintenance.	Sundries.	Total.
Sunday.						
Monday.						
Tuesday.						
Wednesday.						
Thursday.						
Friday.						
Saturday.						
					\$	\$

I Hereby Certify, That the above is a Correct Statement of Expenses incurred by me on behalf of and for the benefit of
C. W. Hunt Company, for the period named, and in connection with the different classes of merchandises as stated on the back hereof.
I also Certify, That my title has been employed as appropriated in the space provided for that purpose on this sheet.

(Signature) _____

Checked by _____ Approved by _____

FORM 9. OUTSIDE AGENT'S EXPENSE STATEMENT.

Form 9. Outside Agent's Expense Statement. Black print on white paper. Size, $8\frac{1}{4}$ inches long by $10\frac{7}{8}$ inches high. Mailed weekly.

Form 10. "Case" Back. Single sheet of stiff manila paper, perforated for two folded brass fasteners at the upper end and printed in large black text at lower right as follows:

Date from.....To
 Location.....
 Subject.....
 Name.....
 Case.....

The size of this "case" back is $8\frac{5}{8}$ inches long by 12 inches high.

All communications relating to factory production are fastened by brass fasteners slipped through punched holes in case back and correspondence sheet, to one of these case backs, which has its spaces, as above, duly filled, and a "case number" given to it, in numerical sequence. The copy of the reply is also fastened to the case back, and all of the correspondence on this subject is added from time to time, as received, with copies of replies, so that each "case," as these aggregations are called, contains all letters relating to the one customer's order. In case the correspondence leads to an order, the case serial number, being in numerical sequence, of course cannot correspond with the order number, which must fall in the drawing numbers sequence.

The "cases" are divided when they grow very thick, two or three inches thickness being the limit. The rule is that no sheet shall ever be removed from the case back on any pretext whatever, and whoever wishes to make use of any sheet must take the whole case. These cases frequently go to the executive engineer and order superintendent in the drawing room. The cases are kept in one place in custody of the chief clerk.

In the same spirit, is the "box" stores ledger, in which all the records of one stores item are kept in one pasteboard box, labelled on the end, and the boxes filed in tiers on each other. See illustration, figure 49.

All the Hunt factory communications are typewritten, a book typewriter being used for filling book forms, such as the

sales book. While this "case" system of correspondence file leads often to the production of a very bulky structure, no sheet of which can be examined without possession of the whole affair, the

Form 11

Date, _____ 190

Daily List of matters that have been referred to

and not checked off the Letter Register

REGISTER NUMBER	NAME	SUBJECT	TO BE ATTENDED TO BY	REMARKS

FORM 11. DECISION DEFERRED.
The original has 22 horizontal blank lines.

Form 12

When the Office Manager or head of Department wishes information from any department a request for the same must be made in duplicate on this form. The reply must also be written out on this form

Date, _____ 190

C. W. HUNT COMPANY.

Case No. _____

From _____ Department.

To _____ Department.

FORM 12. DEPARTMENTAL INQUIRY.
The blank lower portion is not shown.

certainty that the case contains every written paper relating to its topic, goes a long way to excuse all inconveniences arising from the necessity of handling the whole to discover a part. There are often a great many sheets in a single case, but as they are naturally

N. Y. Office.			Factory, General Mail.
Home Office, General Mail.			Executive Engineer.
President.			Plant Engineer.
Vice-President.			Preliminary Engineer.
Secretary.			Chairman Factory Committee.
Controller.			Purchasing Agent.
Chief Engineer.			Book-keeper, H. M. C.
Book-keeper, H. O.			Foreman Machine Shop
Estimate Department.			" Sheet Iron "
Correspondence Department.			" Wood "
Sales Department.			" Pattern "
Automobile Department.			Warehouseman.
Publication			Store-keeper.
Foreign			Photograph Department.
Rope			Mr.
Order			

filed in date sequence, the latest at the top always, there is very little trouble in finding the particular sheet wanted.

Form 11. Decision Deferred. White. Ruled in black, blue and red. Printed in black. Size, $8\frac{3}{8}$ inches long by 11 inches high.

This form is filled at the end of each day, and submitted to the secretary each morning, the secretary being thus informed of all matters left open the previous day.

Form 12. Departmental Inquiry. White. Printed in black. Size, $5\frac{1}{2}$ inches long by $8\frac{3}{8}$ inches high.

This sheet must be filled in duplicate for both inquiry and reply, and one copy is kept by the sender.

Form 13. Manila envelope. Printed with list of departments. Addressed by pencil tick opposite department named. Tick erased and envelope used over again. The "in" and "out" baskets and constantly journeying messenger, are not used in this factory. Envelope not sealed for ordinary use. Size, $6\frac{1}{2}$ inches long by $3\frac{5}{8}$ inches high.

THE DRAWING ROOM FORMS.

Forms used for drawing costs and for producing, handling, storing and delivering drawings and blue prints, are numbered from 14 to 21, inclusive. There are other records kept in the drawing room belonging exclusively thereto, which are not here reproduced, as it would require the full story of the drawing-room system to give them any value. The forms shown are available for use in any drawing room, no matter what the special practice may be, and are as follows:

- No. 14. Drawing Cost Record.
- No. 15. Preliminary Drawing Index Card.
- No. 16. Record of Prints Issued.
- No. 17. Drawings Out of Place.
- No. 18. Blue Print Requisition.
- No. 19. Memorandum of Blue Prints to be Returned.
- No. 20. Print Index Card.
- No. 21. Print Dating Stamp.

Form 14. Engineering and Drawing Time Record. Black print on white paper. Both sides printed alike. Size, $8\frac{3}{8}$ inches long by $10\frac{7}{8}$ inches high.

C. W. HUNT COMPANY.

ENGINEERING AND DRAWING DEPARTMENT.

"PRELIMINARY" WEEKLY TIME SHEET.

DESCRIPTION OF WORK DONE.	"A"		"B"		"C"		Automobiles		H. M. C.		Foreign.		Total.	
	Days.	Hrs.	Days.	Hrs.	Days.	Hrs.	Days.	Hrs.	Days.	Hrs.	Days.	Hrs.	Days.	Hrs.
Domestic														
Total Time,														
Amount, @ Per Hr.,														

I Hereby Certify That the above is a Correct Statement of my time employed on the work specified, for the benefit of C. W. Hunt Company, for the period shown.

Engineer or Draughtsman.

Checked by _____

FORM 14. PRELIMINARY DRAWING AND ENGINEERING TIME RECORD.
The original has 18 blank horizontal lines, and has the word "Foreign" about the middle of the left-hand side.

The form shown is for "preliminary" work. Another form, identical, save reading "Executive" in place of "Preliminary," is used for recording cost of making working drawings.

Form 14 was preceded by a drawing-room time-record form having a detailed record space. It was abandoned because detail or operation costs are of no value where comparisons are impossible. It is only in repetition production that detailed or operation labor costs are useful. Making drawings is never a repetition, and gross time charges are therefore correct.

Form 15. Blue, stiff cabinet filing index card. Size, 5 inches long by 3 inches high.


CASE _____		Form 15	
NAME _____			
ADDRESS _____			
TITLE OF DRAWING		Drawing Number	Portfolio Number
For Instructions For Use See Drawing Number Book.			

FORM 15. PRELIMINARY DRAWING INDEX CARD.

Kept by "librarian" in drawing room. Used for preliminary drawings only. Preliminary drawings are made in response to correspondence inquiries, and hence this form has a "case" number space. Since the correspondence does not always result in an order, the "case" number and the "order" number cannot be the same, and the preliminary drawings cannot bear the same number as the "executive" or shop drawings, which must of necessity bear the order number. Preliminary drawings are made in colored copying ink and "pad" printed copies in colors are sent to the correspondents as suggestions to be modified as may be best.

Form 16. Prints Issued Record. White card. Ruled and printed all in black. Perforated for card-cabinet filing. Size, 5 inches long by 3 inches high.

Form 16 is filled and kept by the librarian, a drawing-room official, who has charge of all drawings and blue prints and "pad" prints. The "pad" prints are made by a youth belonging to the drawing room, on verbal orders from the librarian, who keeps a record on form 16 of all prints sent out, returned, and destroyed. It is at times a matter of much importance to know what prints are outstanding, and it is always important that no print should leave a factory without a record of full particulars.

Form 16		
DRAWING. SKETCH	PRINT NUMBER	PORTFOLIO NUMBER
AUTHORIZED BY	ISSUED BY	DATE ISSUED
RETURNED TO LIBRARY	ISSUED TO DEPT	DESTROYED
DATE.	DATE	DATE
TITLE		
PRINT NO.	SENT	TO
"	"	"
 RECEIVED THE ABOVE		
BLUE PRINTS ISSUED		

FORM 16. BLUE PRINTS ISSUED.

Form 17. Drawings Out. White card; printed all in black. Thin paper, size 5 inches long by 3 inches high.

Executive engineer's order to the librarian to deliver an original drawing for alteration to the drawing-room. The description of the drawing is signed by the executive engineer, and form 16 is then sent to the librarian, who satisfies it by delivery of the drawing required, and files form 17 in the card-index tray with the index card of the drawing and fills the remaining blanks of form 17 as events occur. Thus form 17, in connection with the previous records of the drawing given out, makes up the complete record of the original making of the drawing and of drawing alteration dates.

Form 18. Thin blue paper. Ruled and printed all in black. Size, 5 inches long by 3 inches high.

The order superintendent's order on the librarian for blue

Form 17		DRAWINGS OUT	
DR. SK. NO.		DATE	
TO LIBRARIAN: PLEASE FURNISH <u>ORIGINAL</u> OF			
TO MR.		DEPT.	
FOR <u>ALTERATION REFERENCE.</u>			
Received the above.		EXECUTIVE ENGINEER.	
Sent for		Still Out	
		Returned	

FORM 17. RECORD OF DRAWINGS OUT.

Form 18		BLUE PRINTS.	
Dr.	Port. No.	Date	
TO LIBRARIAN			
You will please furnish this Department with		Print	of
to be used as below :			
No.	For		

FORM 18. REQUISITION FOR BLUE PRINTS.

prints. Blue prints are printed by electric light in the photographing department, and are stamped with form 21 on the back when received by the librarian, who holds them until ordered by the executive engineer or the order superintendent. This form specifies the destination and use of the blue print.

The librarian records all issues of blue prints on forms 20, and then destroys forms 18.

Form 19. Blue card, 5 inches long by 3 inches high.

Draftsman's blue print requisition on librarian. Filled by

Form 19		BLUE PRINTS OUT		DATE _____
Drawing. Sketch Number.		Portfolio Number.		
TO LIBRARIAN: PLEASE FURNISH <u>PRINT</u> OF				
FOR REFERENCE. TO BE RETURNED.				
				Received the Above
<div style="display: flex; justify-content: space-between;"> Sent for Still Out Returned </div>				

FORM 19. MEMORANDUM OF BLUE PRINTS OUT.

DR. _____					Form 20	
Print	TO DEPT.	DATE	RETURNED	Reissued	Returned	Destroyed
1						
2						
3						
4						
5						
6						
7						
8						
9						
0						
						Print Index Card

FORM 20. PRINT INDEX CARD.

draftsman and honored by the librarian, who files forms 19 in a card-cabinet drawer, where they stand as charges against the draftsmen until the loaned blue prints are returned to the librarian, when he destroys the corresponding forms 19.

Knavish employees once smuggled important blue prints out of the Hunt Manufacturing Co.'s works, intending to use them in a rival establishment. Such a theft is now made difficult by the very full blue print records kept. The blue prints from which any factory works are very important secret papers, and all blue print issues should be accurately recorded in all cases.

Form 20. Print index card. White thin card; black print and ruling. Size, 5 inches long by 3 inches high.

The librarian records all issues of prints except loans to draftsmen, on forms 20, using a separate form for each drawing. Spaces are provided for 10 print records from each sheet of drawing. Prints are made by a large "pad" copying process, which gives 10 or 15 good copies, and as many as 20 legible copies, and blue prints by an electric light blue-printing machine.

The drawing number is written in the "DR." space by the librarian, and filed in a card cabinet between tabbed stiff tray cards, numbered in even thousands, in the usual manner.

Form 21. Print-dating stamp. Rubber hand dating stamp impression applied to the back of every print by the librarian when received by him. The impression face is 2 inches long by $1\frac{3}{8}$ high, reading:

C. W. HUNT CO.

DRW. NO.

PRINT NO.

DEC. 30, 1902.

FOR

LIBRARY.

The date is, of course, as may be.

FACTORY PRODUCTION FORMS.

These forms are used in the productive factory operations. The Hunt Company buys its grey iron castings, and these forms include those by which the movements of patterns are directed, as well as the purchase forms. The writing of the bill of material, or order component specifications, must precede the ordering of castings and the purchase of supplies, therefore the bill-of-material forms and the piece tags form are placed here, although they might be grouped with the time cards, which appear near the end of the list of forms.

However, all the forms from No. 22 to No. 59 are so closely connected with the commercial product of the factory, and have such intimate functional relations with each other that they cannot be separated into distinct groups.

Factory production on the customer's order begins with the sales order, form 54, which is the Hunt Company's requisition on the Hunt Manufacturing Company, but as form 54 is often satisfied from finished stores which must always begin production with the bill of material, form 22 or 23, those forms are placed first in the following list:

- No. 22. Miscellaneous Bill of Material.
- No. 23. Pattern and Casting Bill of Material.
- No. 24. Piece Tag.
- No. 25. Order Envelope.
- No. 26. Postal Card Pattern Return Order.
- No. 27. Reply Postal Card, Pattern Shipment.
- No. 28. Reply Postal Card, Pattern Receipt.
- No. 29. Engineer's Daily Report.
- No. 30. Purchase Agent's Quotation File Card.
- No. 31. Factory Requisition on Purchase Agent.
- No. 32. Purchase Order Original.
- No. 33. Carbon Duplicate of Form 32.
- No. 34. Purchase Order Hand Stamps.
- No. 35. Duplicate Invoice Request.
- No. 36. Urgency Supplies Form.
- No. 37. Supplier's Truck Call Notification.
- No. 38. Stores Received Note.
- No. 39. Stores Rejected Note.
- No. 40. Information Wanted, Goods Received.
- No. 41. Bin Card.
- No. 42. Pattern Index Record Card.
- No. 43. Rough Stock Stores Ledger Card.
- No. 44. Rough Stock Cost Ledger Card.
- No. 45. Finished Stores Stock Ledger Card.
- No. 46. Finished Stores Cost Ledger Card.
- No. 47. Order Memorandum Card.
- No. 48. In Process Memorandum.
- No. 49. Figure of Box.
- No. 50. Materials Ordered Box Slip.

- No. 51. Finished Stock Box Slip.
- No. 52. Stores in Progress Box Slip.
- No. 53. Screws, Bolts and Bars Box Slip.
- No. 54. Sales Order.
- No. 54A. Customer's Order Acceptance Notification.
- No. 54B. Factory Accountant's Sales Order Notification.
- No. 54C. Box Office Sales Order Sheet for Ledger Deductions.

No. 54D. Factory Accountant's Sales Order Record.

No. 54E. Executive Engineer's Sales Order Record.

No. 55. Back of Forms 54C, 54D, and 54E.

No. 56. Sales Requisition on Warehouse.

No. 57. Back of Form 56.

No. 58. Inspector's Tag.

No. 59. Factory Requisition on Warehouse.

Form 22. Hunt Manufacturing Company's form D1. Miscellaneous bill of material for order department. Black print, zinc engraving and ruling, on white bond paper. Size, 16½ inches long by 9½ inches high. Margins ¼ inch wide.

Form 23. Hunt Manufacturing Company's form D2. Pattern and casting bill of material for order department. Same size and general description as form 22, with the exception of the necessary difference in a few headings. Not engraved.

Form 24. Hunt Manufacturing Company's form F. Piece Tag. Manila; printed all in black. Size, 3½ inches long by 5 7-16 inches high.

Form 24 is wired in stores to every piece sent into the factory departments, and remains with the material until the finished work passes inspection. The piece tag is then sent to the works superintendent, and is filed by him. No charges are made from the piece tag, which is merely an identifying passport, which passes the component through the factory, and tells what it is, and to what production order the piece belongs.

The "In Work" order and the component passport and identification direct the course of material in the shops, and in addition record the weights of materials, and so, taken in connection with the related time cards, enable the factory accountant to fill the factory cost spaces of the sales orders, on forms 22, 23 and 54. Forms 22, 23 and 24 are thus seen to be the factory

FORM

D

Form 22

— INSTRUCTIONS FOR USING THIS FORM —

1. NO MATERIAL MAY BE SUPPLIED FROM STORE OR PURCHASED UNLESS FIRST AUTHORIZED BY A BILL OF MATERIAL.
2. THE DRAFTERMAN WILL FILL UP IN COPIES INK COLUMNS 1 TO 13 INCLUSIVE AND HAND TO CHIEF DRAUGHTSMAN DRAWINGS AND BILLS.
3. THE EXECUTIVE ENGINEER WILL ON THE SAME AND TRANSMIT TO CHIEF DEPARTMENT.
4. THE CHIEF DEPARTMENT WILL TRANSMIT TO CHIEF ENGINEER BY SYSTEM CHART 2.
5. THE CHIEF ENGINEER WILL TRANSMIT TO CHIEF WORKS SUPERINTENDENT ALONG WITH DRAWINGS AND PRICE TAGS, AND HE WILL DEAL WITH THEM AS PRESCRIBED BY SYSTEM CHART 3.
6. THE CHIEF WORKS SUPERINTENDENT WILL TRANSMIT TO THE WORKS SUPERINTENDENT ALONG WITH DRAWINGS AND PRICE TAGS, AND HE WILL DEAL WITH THEM AS PRESCRIBED BY SYSTEM CHART 3.
7. COPY FOR RECORDS TO THE WORKS SUPERINTENDENT.
8. COPY FOR RECORDS TO THE WORKS SUPERINTENDENT.
9. COPY FOR RECORDS TO THE WORKS SUPERINTENDENT.
10. COPY FOR RECORDS TO THE WORKS SUPERINTENDENT.
11. COPY FOR RECORDS TO THE WORKS SUPERINTENDENT.
12. COPY FOR RECORDS TO THE WORKS SUPERINTENDENT.
13. COPY FOR RECORDS TO THE WORKS SUPERINTENDENT.

SHOP ORDER NUMBER		ASSEMBLY SYMBOL	GENERAL SUBJECT OF BILL OF MATERIAL		ORIGINATING DEPARTMENT	DATE NEEDED BY
NUMBER OF PIECES	1	2	3	4	5	6
	7	8	9	10	11	12
NAME OR DESCRIPTION OF PIECE		MATERIAL	QUANTITY		DIAMETER OR THICKNESS	WIDTH
LENGTH		WEIGHT OF STOCK IN LBS.	WEIGHT OF FINISHED WEIGHT IN LBS.			
1		2	3	4	5	6
7		8	9	10	11	12
13		14	15	16	17	18
19		20	21	22	23	24
25		26	27	28	29	30
31		32	33	34	35	36
37		38	39	40	41	42
43		44	45	46	47	48
49		50	51	52	53	54
55		56	57	58	59	60
61		62	63	64	65	66
67		68	69	70	71	72
73		74	75	76	77	78
79		80	81	82	83	84
85		86	87	88	89	90
91		92	93	94	95	96
97		98	99	100	101	102
103		104	105	106	107	108
109		110	111	112	113	114
115		116	117	118	119	120
121		122	123	124	125	126
127		128	129	130	131	132
133		134	135	136	137	138
139		140	141	142	143	144
145		146	147	148	149	150
151		152	153	154	155	156
157		158	159	160	161	162
163		164	165	166	167	168
169		170	171	172	173	174
175		176	177	178	179	180
181		182	183	184	185	186

[illegible]

FORM 22. MISCELLANEOUS BILL OF MATERIAL.
Second part, to be joined to first part along left-hand line.

production forms, none of the other forms ever entering the factory departments.

These factory forms are prepared by the draftsmen, vised by the executive engineer, and by him given to the order superintendent for placing in their proper envelopes with the working drawings, to be transmitted to the works superintendent.

Form 24

Form F

PIECE TAG	To be wired to piece in stores and remain attached in shops. Warehouseman will remove card before shipping and send it to Works Superintendent.
Shop Order Number	Piece Number
Assembly Symbol	No. of Pieces for Job
Class of Machinery	Description of Piece
Pattern Number	Portfolio Number
Drawing Number	Bill of Material No.

COURSE OF MATERIAL IN SHOPS			
DEPT. NO.	DATE COMPLETED	DEPT. NO.	DATE COMPLETED.

INDEX TO DEPARTMENT NUMBERS					
No	Department	No	Department	No	Department
1	Stores	11	Forge	21	Warehouse
2	Cutting Off	12	Punch & Shear	22	Shipping
3	Lathes & Scwg.	13	Saws	23	
4	Mill'g & Sha's	14	Riveting	24	
5	B. M. G'r Cuts	15	Flanging	25	
6	Turner Lathes	16	Setting Up	26	
7	Drills	17	Painting	27	
8	Benchies	18	Patterns	28	
9	Planer	19	Brass Foundry	29	
10	Erecting Bench	20	Wood	30	

FORM 24. PIECE TAG.

In earlier practice an official, styled the "job clerk," was placed in the factory to receive the order envelope from the order superintendent, and direct the course of materials from the rough stores through the factory departments, but this arrangement did not produce satisfactory results, and was superseded by the present piece-tag directions method, by which the draftsman who fills

the piece tags directs the departmental operations on the components.

Five copies are made of each filled bill of material, forms 22 and 23. One record copy is retained and filed by the order superintendent for use of the executive engineer, and four copies are sent with the piece tags and blue prints, all enclosed in a manila envelope which takes drawings flat, to the works superintendent, who first consults the bill-of-material delivery-date column, which informs him when the order should be put in work. Because of the daily consultation of the chief factory officials, the works superintendent is of course made aware of the approach of the order before it reaches him.

When the order is to be put in work the work superintendent sends the piece tags and one copy of each bill of material to the storekeeper, who receives and has charge of castings, forgings, bars, lumber and rough stores in general, who attaches the piece tags, forms 24, previously filled by the order superintendent from bill of material specifications, including the factory operation sequence, to material to satisfy, and piles the material on the factory railway cars, ready for electric traction to the first operation department.

The second copy of each bill of material is sent to the factory accountant, and the third copy of each to the department foremen's office, which is common to all of them, and the works superintendent then files the remaining, or fourth, copy of the bill of material in his own office.

Form 25. Heavy manila envelope, reinforced narrow flap at one end, very substantial. Size, $7\frac{5}{8}$ inches long by $10\frac{3}{8}$ high. Printed in black, in large, full-face type, as follows:

At top, "Shop Order No.....";
in middle of face;

"In this envelope file the

Bill of Material, D1,

Bill of Material, D2.

Time Cards.

Expense Account;"

and at foot of front of envelope in two lines,

"Finished, 190

"Filed by.....Shop Order No.....

On the back, at foot, reversed, is printed,
"Shop Order No.,"
so that the order number will be visible either side up.

These envelopes, form 25, are kept by the factory accountant,
who receives the time cards daily, and who has a copy of form

Form 26

West New Brighton, N.Y., _____

Gentlemen:

Please return to us the following patterns:

Number of Pieces in the Pattern	Number of Core Boxes.	Name or Number on the Pattern	Remarks

Mark: C. W. HUNT COMPANY,

45 Broadway, New York,

and ship via _____

Yours truly,

C. W. HUNT COMPANY,

per _____

FORM 26. POSTAL-CARD ORDER FOR RETURN OF PATTERNS.

54, and sorts the time cards to their order number envelopes,
forms 25, after making the workmen's pay roll from them.

In this envelope, form 25, the same motive of keeping all
related documents in one enclosure appears, that is shown in
the "case" and the stores-ledger "box."

Form 26. Postal Card Pattern Return Order. Printed on
the back of a postal card, in purple. Size, 3¼ by 5½ inches.

Filled by the store keeper or by the purchase agent, and sent to the holder of the pattern. The company buys its castings from various foundries.

Forms 27 and 28, are printed in purple on the two message faces of a return postal card, form 27 being filled by the job

West New Brighton, N.Y., _____ 19____ _____ _____																															
Gentlemen: <p style="text-align: center;"><i>We have to-day sent you the following</i></p> patterns, via _____																															
<table border="1"> <thead> <tr> <th>Number of Pieces in the Pattern.</th> <th>Number of Core Boxes.</th> <th>Name or Number on the Pattern.</th> <th>Remarks.</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>				Number of Pieces in the Pattern.	Number of Core Boxes.	Name or Number on the Pattern.	Remarks.																								
Number of Pieces in the Pattern.	Number of Core Boxes.	Name or Number on the Pattern.	Remarks.																												
<p style="text-align: center;"><i>Please receipt and mail the return postal card.</i></p> <p style="text-align: center;">Yours truly,</p> <p style="text-align: center;">C.W. HUNT COMPANY,</p> <p style="text-align: center;">per _____</p>																															
Form 27																															

FORM 27. POSTAL CARD NOTIFICATION OF PATTERN SHIPMENT.

clerk, and form 28 by the founder on receipt of pattern. Form 28 is not shown.

Form 29. Engineer's Daily Report. Black print on white paper. Size, $8\frac{3}{8}$ inches long by 11 inches high. Filled by the engineer, and sent to the executive engineer daily.

Form 30. Purchase agent's quotation index file card. Ruled in red, blue and black, printed in black, on white card. Size, 5 inches long by 3 inches high. Filled and filed by the pur-

chase agent in his card cabinet. A separate card is used for each supply item.

Form 31. Factory Requisition on Purchase Agent. Ruled

Form 29

ENGINEER'S DAILY REPORT.

HUNT MANUFACTURING COMPANY.

Date, 190

READING TO BE TAKEN AT	7:00 A. M. Yesterday.	5:30 P. M. Yesterday.	7:00 A. M. To-day.
Weight of hard coal, pounds			
Weight of soft coal, "			
Water-meter, in cubic feet			
Water-meter in pounds of water			
Evaporation, pounds of water per pound of coal			
Watt-meter reading			
Watt-meter in Watt hours			
Temperature of feed water, Degrees Fahrenheit			
Temperature of room, Degrees Fahrenheit			
Temperature of flue gases, Degrees Fahrenheit			
Weight of ashes, pounds			

REMARKS:

Engineer.

FORM 29. ENGINEER'S DAILY REPORT.

in red and blue, printed in black, on white sheet. Size, 8¾ inches long by 9¾ inches high. Pad form, serially numbered in blue. Filled in the box office, from maximum and minimum



stores orders, or by the works superintendent or by the order superintendent, in pencil; sent to the purchase agent, and held by him.

Form 32. Original Order. Printed in purple on white paper. Size, $5\frac{5}{8}$ inches long by $11\frac{3}{4}$ inches high. The serial number appears in two places on both original and duplicate. Separated at perforations, on line AB. Filled by the purchase agent in duplicate and the upper part sent by him to the warehouseman. The lower part is sent to the supplier. The "mark" space is filled with a rubber-stamp impression.

Quotations on						Form 30
From						
Address						
Date of Quotation	Article	List Price	Discount	Net Price	Remarks	

FORM 30. PURCHASE AGENT'S QUOTATION CARD.

Form 33. Carbon copy of 32 in typewritten text and serial numbering. Filled by the purchase agent in carbon duplicate at the filling of form 32. Separated on line AB, and the top part sent to the storekeeper, while the lower part of form 33 is filed by the purchase agent with form 31. Not engraved.

Invoices from outside suppliers are received by the purchase agent, compared with his purchase order record, and sent to the storekeeper, who checks them to stores received, and then sends the checked invoice and the top part of related form 33 to the box office for entry on the stores card or box ledger.

Form 34. Rubber hand stamp impression applied to supplier's order upon occasion, with legend:

OUR TRUCK WILL CALL.

Size, $1\frac{1}{4}$ inches long by $\frac{3}{8}$ inches high.

Also rubber hand stamp impression for orders to be sent to works, with legend:

WEST NEW BRIGHTON, S. I.

CARE OF S. I. R. T. R. R.

FOOT WHITEHALL ST., N. Y.

Size, $1\frac{7}{8}$ inches long by $\frac{1}{2}$ inch high.

Form 35. Duplicate invoice request. Printed in black on back of postal card; size $5\frac{1}{2}$ inches long by $3\frac{1}{4}$ inches high.

C. W. HUNT COMPANY,

West New Brighton, N. Y.

Please send duplicate bills by return mail for.....

.....

Yours respectfully,

C. W. HUNT COMPANY.

Per

All invoices for this company should be made in duplicate.

Form 36. Suppliers' Urgency Form. White sheet, printed all in purple. Size, $8\frac{3}{8}$ inches long by $10\frac{5}{8}$ inches high.

This is a return form, relating to unexpected factory requirements. Sent by the purchase agent to the supplier, who is requested to return the same sheet with specification of delivery date. This form has ample space for the full specifications which are demanded by emergency action, but are often neglected in case of hurried action.

Form 37. Truck call notification to supplier. Thin, pale yellow slip, printed in black. Size, 8 by $3\frac{1}{2}$ inches. Filled by the purchase agent and sent to the warehouseman. Order to supplier to deliver to Hunt truckman. Not engraved.

Form 38. Stores Received Note. Light brown bond paper, printed and ruled all in black. Size, $8\frac{1}{4}$ inches long by 4 inches high. Castings received form. Filled by the storekeeper, sent with the checked invoice to the box office clerk, who records items on stores ledger, and then sends the invoice with form 38 to the commercial accountant.

DATE Dec. 20th, 1902.

ORDER No. 41160

Form 32.

ORDERED FROM John Doe,

Stock

New York City,

10 Kegs $3/8 \times 3/4$ Round Head Rivets.

A-----B

A CHECK WILL BE MAILED ON THURSDAY IN PAYMENT FOR ALL MATERIALS
DELIVERED AND BILLED ON THIS ORDER DURING THE PRECEDING WEEK.

IF THIS ORDER CANNOT BE EXECUTED IMMEDIATELY, PLEASE ADVISE AT ONCE.
OR THIS ORDER MAY BE CANCELLED.

Stock.

C. W. HUNT COMPANY,

GEO. S. HUMPHREY, PURCHASING AGENT,

WEST NEW BRIGHTON, N. Y.

Order Number

41160

December 20th, 1902.

John Doe,

New York City,

Please furnish this Company with the following articles, sending
duplicate bills for each consignment, and noting on the bill the number
of this order and the number of packages. Delivery must actually be
effected within the time stated in this order, otherwise the order may
be cancelled.

10 Kegs $3/8 \times 3/4$ Round Head Rivets.

Mark: C. W. HUNT COMPANY.

Purchasing Agent.

Ship via _____

Form 36

SUPPLIERS' URGENCY FORM 84.

TELEPHONE No. 101 WEST BRIGHTON, NEW YORK.

CABLE ADDRESS, "Sandshovel, New York."

DOMESTIC TELEGRAPH ADDRESS,

West New Brighton, Staten Island, N.Y.

WORKS OF THE

C. W. HUNT COMPANY

WEST NEW BRIGHTON,
STATEN ISLAND, NEW YORK.

Date, _____ 190

GENTLEMEN:

We beg to inform you that the goods mentioned below are
URGENTLY REQUIRED. Please return this form to us at once, stating DEFINITELY in space below
when we may expect delivery.

Yours truly,

C. W. HUNT COMPANY,
per

OUR ORDER NUMBER	GOODS REFERRED TO	STATE HERE WHEN DELIVERY WILL BE EFFECTED

Date, _____ 190

C. W. HUNT COMPANY
GENTLEMEN:

We will deliver the goods required at the time specified above

Yours truly,

per _____

Form 38

STORES RECEIVED NOTE No. _____

Date _____ 190_____

Received from _____ via _____

Number of Pieces	MATERIAL AS SPECIFIED BELOW	Store Reference No.	Weight in Lbs.	Added to Boxes	REMARKS

Received by _____

Receiving Clerk _____

Added to Boxes by _____

Certified as to quality and quantity _____ Storekeeper.

Freight or Express Charges, if any _____

FORM 38. STORES RECEIVED NOTE.

STORES REJECTED NOTE No. _____

Date _____ 189__

Form 39

Returned to _____ via _____

Number of Pieces	PACKAGES ASUNDER AND NUMBERED.	Weight in Lbs.	Value Each.	Total Value	REMARKS AND REASONS WHY REJECTED.

Signed as to forwarding package, _____

Signed as to quantity rejected, _____

_____ Shipping Clerk.

_____ Storekeeper.

Form 39. Stores Rejected. White paper, purple print and ruling. Size, $8\frac{1}{2}$ inches long by $3\frac{3}{4}$ inches high. Filled by the receiving clerk from inspector's rejection, rejection noted on invoice, and filled form 39 sent to the commercial accountant.

Form 40. Information Wanted. Goods Received Note. Printed in purple ink on blue paper. Size, $8\frac{1}{2}$ inches long by $3\frac{7}{8}$ inches high. This form is used in case of return of factory product under question. Filled by the storekeeper and sent to the factory accountant, who refers it to the executive engineer.

Form 41. Stiff manila "Bin Card." Size, $4\frac{1}{8}$ inches long by $6\frac{7}{8}$ inches high.

Form 41			
NAME _____			
REFERENCE No _____		BIN No _____	
MAX. _____		MIN. _____	
WT. _____			
QUANTITY			
DATE	RECEIVED	ISSUED	ON HAND

FORM 41. BIN CARD.
The original has 17 horizontal blank lines.

Nailed to bin containing material. Blanks filled by the storekeeper, who has charge and keeping of all rough stores. The same record which is carried by form 41 appears in the stores card index record, or in the "box" record, kept in the box office. Form 41 gives information on the spot, without consulting the stores inventory or ledger or the box record.

Form 42. Pattern Record Card. White stiff index tab card. Printed all in black. Size, exclusive of tabs, 6 inches long by 4 1-16 inches high. Printed the same on both sides.

This card is filled by the engineering department, and is kept in a card-index cabinet tray in the box office, and gives a

[illegible]

FORM 45. FINISHED STORES STOCK LEDGER CARD.

full history of the pattern and a complete record of its travels. Filled and filed by the box clerk, in "position 5."

Form 43. Rough Stores Stock Ledger Card. Salmon Color. Stiff card, double index tabs, printed the same on both sides in black text and ruling. Size, 6 inches long by 4 1-16 inches wide.

This form is a record of all receipts and disbursements of the rough stores item to which it relates. It is filled by the box clerk, and kept in a card index cabinet in the box office, in position 1, next the front of the cabinet drawer. There are 4 of these

Form 47	
ORDER MEMORANDUM.	
THE FOLLOWING ARTICLES HAVE BEEN ORDERED,	
Date of Order	For Shop Order No.
Order Number	For N. Y. Sales No.
Ordered from	Shipment Expected
Material Ordered	Goods were received
.....	Remarks
.....
.....
No. Ordered	Entered on the stock card by
Pattern No.	Date 190.
This slip is to be kept in the cabinet of the article until the receipt of the goods, when the entry is to be made on the Stock Card and this slip filed away.	

FORM 47. ORDER MEMORANDUM.

position cards, for related items, and a fifth one for pattern records.

Form 44. Rough Stores Cost Ledger Card. Stiff white card, index tabs on both sides, both sides printed alike, print and ruling all in black. Size, 6 inches long by 4 1-16 inches high. Position 2. Filled and filed by the box clerk.

Form 45. Finished Stock Card. Position 3. Stiff, buff colored card, tabs both sides, printed in black, with black ruling, alike on both sides. Size, 6 inches long by 4 1-16 inches high. The record borne by this card shows all receipts and disburse-

ments of the finished stores item to which it relates. It is filled by the box clerk, and kept in a card-index cabinet in the box office.

Form 46. Finished Stock Cost Card. Position 4. Stiff blue card, tabs on both sides; printed in black, the same on both sides. Size, 6 inches long by 4 1-16 inches high. It is filled by the box clerk, and kept in a card-index cabinet in the box office.

Form 47. Order Memorandum. Thin blue paper tab card. Print and ruling all in black. Size, 6 inches long by 4 inches wide, exclusive of tab at upper right hand corner. It is filled

Form 46	Position 3A	IN PROCESS MEMORANDUM.		Date issued.....
Goods being Manufactured				
Name.....		Stock Reference No.		
Quantity being Manufactured		On Shop Order.....		
Made for		On Sales Order		
Filed in Storekeeper's box by		Charged to Customer on Stock Reg. Note by		
Filed in pink slip file box by		Added to Stock Card by 190		
<p><small>This card is to be filled out by the Order Clerk when an order is put in the Works for the manufacture of an article, and passed immediately to the Storekeeper, who will file it in its proper location in cabinet or see that it is charged on stock requisition note to customer. This card is to be taken out of the cabinet and filed with pink slips by the Storekeeper when the notification is received on Foreman's Finished Goods Delivery Note that the article has been completed.</small></p>				

FORM 48. IN PROCESS MEMORANDUM.

by the box clerk, from the purchase agent's notification, or from the bill of material notification, and filed in the box office.

Form 48. In Process Memorandum. Pink, thin paper; print and ruling all in black. Size, 6 inches long by 4 inches high, exclusive of tab at upper right hand corner.

It is filled by the order superintendent when production begins, and sent to the storekeeper, and, if regular, filed in cabinet, position 3A, or, if special, charged to customer. See footnote on this form.

THE BOX OFFICE.

The box office is a separate office by itself, and is occupied by the box clerk and his assistants whose duties are to fill the "value each" column on forms 54, and make the stores ledger deductions, and fill the "when deducted" date columns of forms 54, and to fill the bills-of-material component item prices. The box clerk handles no material, and has nothing in his charge except the "boxes" and the rough and the finished stores ledger card files. He gives out weights and costs only. The bills of material sent to the factory accountant are by him sent to the box office for material costs and are returned to the factory accountant when the prices are all filled in for each component specified on the sheets.

Weights known in the box office are furnished on application by proper persons, but the regular duties of the box office are the pricing of the sales orders, forms 54, forms 56 and forms 22, and keeping the box and card index ledger, making additions and deductions as stores are replenished and disbursed.

The forms handled in the box office are: 7, 12, 13, 22, 23, 33, 37, 38, 39, 40, 42, 43, 44, 45, 46, 47, 48, 50, 51, 52, 53, 54C, 55, 56, 57, 59, 60, 67, 68 and 69.

The box office receives notice of all purchase orders except rope, of all finished stores produced by the factory, of sales orders, and of all sales shipments, and keeps the rough stores ledger, except "stevedore" rope accounts, and the finished stores ledger; the factory cost of each piece appears in the ledger records. All sales are made by the piece, not by weight, and very little weight recording appears anywhere in this factory or in its sales invoices.

The box office fills the factory price space of every factory stores item, both when received, the record being then written on the ledger card, and when sold, the piece price record being made on the sales order after shipment by the warehouseman. The box office is simply the piece ledger keeper and piece pricer for the factory.

The box clerk has two assistants and a boy, who waits on the three men, bringing and returning "boxes," cards, or card trays, as requested.

All of the small tools, dies, taps, reamers, mills, squares, straight-edges, surface plates and so on, are indexed in a card file in the box office; files, emery cloth and waste are also indexed in the box office. When small tools are needed in the factory any foreman may make a requisition, and send it to the box office, where deductions are made and the requisition is sent to the factory accountant, who charges the small tools, which are thereafter stored in the factory tool room, to standing orders, differently numbered for different departments, the articles being delivered by the storekeeper.

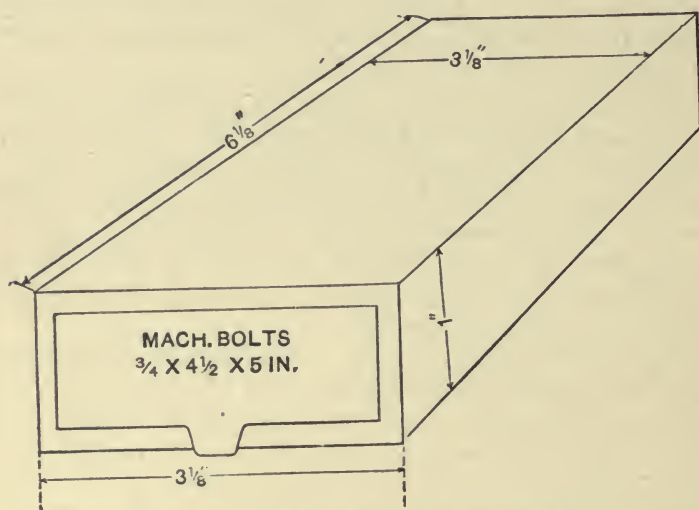


FIGURE 49. BOX FOR HOLDING RECORDS OF STORES.

Figure 49. Stores slip ledger box, kept in "box office" by the box clerk.

This box consists of an outer case of card board, covered with black muslin, both ends open, and a sliding, card-board, muslin-covered tray to slide inside the outer case, the tray having a cloth tab projecting in front, and the front inscribed with the name and dimensions of the stores item to which the box record relates. The box sketched holds all information relating to machine bolts, $\frac{3}{4}$ inches diameter and of two lengths, $4\frac{1}{2}$ and 5 inches. For such stores items as have a great variety of dimensions, as screws, bolts, cotter pins and so on, this form of stores

ledger is held superior to a card index. The use of these boxes, which are kept in an office at the end of the stores, gives that room the title of "box office." The boxes are arranged in stacks 25 boxes high, by glueing black woven fabric around the stack of outside cases, and these stacks are kept in large shelf compartments, each holding 10 stacks of 25 boxes in each, 250 boxes in each compartment, and 3 compartments to a shelf length, making 750 boxes in one tier, or on one shelf. As each receipt and delivery of material demands an entry on one of the record slips, forms 50, 51, 52 or 53, a combined desk and seat, mounted on rollers, is provided to travel across the front of the box stacks, so that records can be made on the spot. The record slips contained in the boxes provide record entry spaces as follows: On form 50, record of items ordered for a certain order number production; on form 51, for finished stock or stores, store room supply; on form 52, stores in progress, with particulars of stores destination and disposition; and on form 53, for the item ledger record. These four forms go easily into the sliding box tray, and the traveling desk and seat permit the box clerk to make entries on these box slips with as little time and labor expenditure as may be.

There were at one time, nearly 8,000 of these boxes in use by the Hunt company, and the "bin cards," form 41, duplicated many of the records on the box slips. Now the number of boxes has been reduced about nine-tenths, the discarded box records being transferred to a card-index ledger, kept in the box office, in cabinets of the usual description, on forms 42 to 48, inclusive. All of this very forcibly exhibits the great difficulty experienced in maintaining a reliable record of stores obtained partly by purchase and partly by factory production, many of them bulky, and so requiring a great area of storage room, and many of them stocked in a vast array of lengths and diameters. While the card index is the almost universally accepted form of factory stores ledger, there are other examples besides this one shown from the Hunt works, of modern factory organization in which the card-index stores ledger is supplemented by a record in another form. Uncertainty as to the accuracy of the stores ledger record leads to intolerable confusion and delay in production and ship-

ment, and the stores ledger is a point of vital interest in factory management.

The Hunt boxes are an original conception; the fully exposed box end inscriptions and the division of the boxes into compartments holding each 10 stacks, 25 boxes high, make it very easy to select the particular item required; and the fact that 750 of

Form 50	Form 52
<p>C. W. HUNT CO.</p> <p>ORDER MEMORANDUM.</p> <p><small>This slip is to be kept in the box of the article until the receipt of the goods, when the entry is to be made on the box Stock Ticket and this slip filed away.</small></p> <hr/> <p>THE FOLLOWING ARTICLES HAVE BEEN ORDERED.</p> <p>Date of Order.....</p> <p>Order Number</p> <p>Ordered from.....</p> <p>Material Ordered</p> <p>.....</p> <p>No. ordered.....</p> <p>Pattern No.....</p> <p>For Shop Order No.....</p> <p>For N. Y. Sales No.....</p> <p>Shipment Expected.....</p> <p>Goods were received.....</p> <p>Remarks</p> <p>.....</p> <p>Entered on the box stock ticket by.....</p> <p>Date.....190...</p>	<p>Goods being manufactured</p> <p>Name.....</p> <p>Reference No.....</p> <p>On Shop order.....</p> <p>Quantity.....</p> <p>Made for.....</p> <p>On Sales order.....</p> <p>Chgd. to customer on Stock Reg. Note by.....</p> <p>Filed in storekeeper's box by.....</p> <p>Filed in pink slip file box by.....</p>

FORM 50. BOX SLIP FOR MATERIALS ORDERED.

FORM 52. BOX SLIP FOR STORES IN PROGRESS.

these Hunt ledger boxes are retained side by side with a card stores ledger, gives this box, traveling desk and box clerk's seat special interest.

Form 50. Box Slip, Materials Ordered Record. Pale blue bond paper, printed all in black. Size, 2 $\frac{7}{8}$ by 5 $\frac{1}{2}$ inches.

Filled by the box clerk either from maximum and minimum

statement, or on orders from the order superintendent's bill of material, or from the job card, and sent to the box office. Forms 31, purchase requisition, are filled by the box office from forms 50, and sent to the purchase agent, and forms 50 are filed in related box until the receipt of material, when forms 50 are taken from the boxes and filed away.

[illegible][illegible]

FORM 51. BOX SLIP FOR FINISHED STOCK. FORM 53. BOX SLIP FOR SCREWS, BOLTS AND STEEL BARS.

Form 51. Finished Stock Box Slip. Yellow bond paper, printed all in black. Size, $2\frac{7}{8}$ by $5\frac{1}{2}$ inches. Filled by the box clerk, and kept in box in the box office.

Form 52. Stores in Progress Box Slip. Pink bond paper, printed all in black. Size, 27 $\frac{7}{8}$ by 5 $\frac{1}{2}$ inches. Filled by the box clerk, and kept in box in the box office.

Form 53. Screws, Bolts and Steel Bars Stores Record. Box Slip. Yellow bond paper, printed all in black. Size, $2\frac{7}{8}$ by $5\frac{1}{2}$ inches. Filled by the box clerk, and kept in box in the box office.

SALES FORMS.

Customer's orders are sent by the correspondence clerk to the controller, accepted, and sent to the order clerk, at his desk on the drawing room floor.

The sale is the important factory event, and affects many officials, who must be duly notified of the sales form and items. In the present instance the C. W. Hunt Company orders the Hunt Manufacturing Company to ship the sale to the customer, and send the bill of items, extended at factory prices and accompanied by factory certification of shipment, to the Hunt Company's controller, who extends the customer's prices, and sends the Manufacturing Company's bill to the bill clerk, who makes the customer's invoice therefrom. The order clerk must retain a copy of his sales order, which is a translation, made by the order clerk, of the customer's order into specific factory terms. The order clerk then has six copies of his translation made in carbon copies from a pad book, all six copies bearing the same serial number, and being simultaneously filled by manifolding on his book typewriter.

These six sales forms are as follows: Form 54, 54A, 54B, 54C, 54D, and 54E, and the last three have form 55 printed on their backs.

The description and handling and filing of these six sales forms, three of which are printed with form 55 on the back, making in all a total of nine factory forms for each sale, is as follows:

Form 54. White paper, black print and ruling, red serial number. The same red serial number appears on all forms from 54 to 54E, inclusive. Size, $8\frac{3}{4}$ inches long by $8\frac{1}{2}$ inches high.

This form is filled by the order clerk's typewriter, carbon copies of the text being at the same time printed on all forms from 54 to 55. Book pad of series of six sheets all of the same serial number. Perforated at left hand margin for typewriter register pins. This is the order clerk's record of performance, and is filed and kept by him.

[illegible]

FORM 54. SALES ORDER.
A little of the blank part is omitted.

Form 54A

PURCH. ORDER No.
PURCHASER

ORDER REC'D VIA
ORDER ENT'D BY
DRAWING
SALES No. 23705

PORTFOLIO
DATE,

CONSIGNEE

MARKS
VIA
We Expect to
Ship About

THIS IS AN EXACT COPY OF YOUR VALUED ORDER AS ENTERED.
IF ANY DISCREPANCY, KINDLY NOTIFY US AT ONCE.

We accept the order on the condition that the goods are at your risk after our delivery to a transportation company in good order, and that if we are unable to deliver the goods as above we shall not be liable to you in damages for such non-delivery. If these conditions are not satisfactory, please notify us at once. The absence of such notice will constitute an acceptance of the conditions.

Terms, Cash 30 days from the date of the Bill of Lading.
F. O. B. at our works.

Very respectfully yours,
C. W. HUNT COMPANY,
Per _____

Form 54 is simply a translation of the customer's order into factory terms, of unmistakable significance, made by the sales agent so that there shall be no mistake made.

Form 54A. Pale blue, fine paper, print and ruling in black. Size, $6\frac{1}{4}$ inches long by $8\frac{1}{2}$ inches high. Perforated separation line at A B.

Filled with the same items specification as forms from 54 to 54E, customer's notification of order acceptance. Torn from book pad on perforated line A B after filling, and mailed by the order clerk to the customer.

Form 54B. Carbon copy of text of form 54. Pink sheet, fine paper, same serial number in red as form 54. Size $6\frac{1}{4}$ inches long by $8\frac{1}{2}$ inches high. Not engraved.

Sent by the order clerk to the order superintendent, and by the latter to the factory accountant, who files it in his sales order book by gumming. Forms 54B are filed on the left hand pages of the factory accountant's order book, and are the factory accountant's sales notification, used for all sales except "stevedore" rope.

Form 54C. Fine yellow paper, printed all in black. Perforated in left hand margin. Same size, print, serial number and filling as form 54, it being a carbon copy of 54.

Sent by the order clerk to the order superintendent, by him to the box office for factory price and stores ledger deduction, by the box clerk to warehouseman, who adds weights, and after shipment sends this form to the factory accountant, who makes the factory cost extensions, and sends the form to the Hunt Co.'s controller, who fixes the customer's price and sends the form to the bill clerk, who makes customer's invoice.

Form 54D. Yellow, same in every way as form 54C. It goes from the order clerk to the order superintendent, to the box office, to the factory accountant, and is by him filed on the right hand page of the factory sales book. Not engraved.

Form 54E. Fine yellow paper, duplicate in print, text and ruling of forms 54C and 54D. It is filled by the order clerk, sent to the executive engineer, and by him placed on file. This is the executive engineer's sales notice, and may call for the production of working drawings and extended factory operations. Not engraved.

Form 54C	<p>SALE MADE BY</p> <p>INVOICE No. _____</p> <p>SALES No. 23705</p> <p>SHOP ORDER No. _____</p> <p>FORWARD TO _____</p> <p>MARK } CASES }</p> <p>VIA _____</p> <p>GOODS REQUIRED BY _____</p>	<p>DEPARTMENT</p> <p>STOCK REQUISITION NOTE No. _____</p> <p>H. M. C. SALES ORDER No. _____</p> <p>DEDUCTED FROM BOXES BY _____</p>	<p>DOMESTIC OR FOREIGN</p>	<p>DATE ISSUED FROM SHOP OFFICE _____</p>			
<p>COMPLETE DESCRIPTION OF GOODS</p>							
QUANTITY REQUIRED	Distinctive Heading	When deducted from Boxes, Check	Articles Manufactured Under E. O. Number	AT FACTORY COST Value Each	Total Value	SELLING PRICE Value Each	Total Value
<div style="border: 1px solid black; width: 100%; height: 100%;"></div>							
<p>IF GOODS ARE NOT IN STOCK WAREHOUSEMAN MUST REPORT ON THIS FORM.</p>							
<p>WAREHOUSEMAN</p>							

FORM 54C. BOX OFFICE SALES ORDER SHEET FOR LEDGER DEDUCTIONS.
Some of the blank portion of the original is omitted.

[illegible]

FORM 55. BACK OF FORMS 54C, 54D AND 54E.
Some of the blank portion of the original is omitted.

[illegible]

FORM 56. SALES ORDER. AMPLIFIED FORM.
Some of the blank portion of the original is omitted.

Form 55. Back of forms 54C, 54D and 54E. Printed in black. Size, $8\frac{3}{4}$ by $8\frac{1}{2}$ inches. It is filled by the warehouseman at the time of shipment, and sent to the executive engineer. It is punched in left hand margin for book typewriter register pins, the perforations also serving for filing.

Form 54 is filled in triplicate by the C. W. Hunt Company sales office, and sent to the executive engineer of the Hunt Manufacturing Co., by him vised and sent to the order superintendent, who fills form 56 as needed to supplement forms 54, and sends form 56 to the box office, whence forms 54 and 56 are sent to the warehouseman, who ships the order as directed. Form 54 is used for all sales records, and may cover any ship-

Form 58

C. W. HUNT COMPANY,

STOCK CARD.

Shop Order No. _____

Reference No. _____

Name _____

For _____

FORM 58. INSPECTOR'S TAG.

ment, and may require engineering and drawings, all of which are authorized by sending form 54 to the executive engineer. The "complete description of goods" space of form 56 may contain an itemized list of the pieces to be shipped, or may contain only the general title and order number of an entire coal or ore handling plant. In general terms, the executive engineer takes steps to enable the factory to meet the sales requisition, and the shipment is finally made on authority of this form 54.

Form 56. White thin paper. Print and ruling all in purple copying ink. Size, $7\frac{3}{8}$ inches long by 10 inches high.

Form 56 is used where form 54C, of the same size and print as form 54, has not surface enough to contain an itemized

record of the sale. Form 54 is used for every sales order, great or small, and may give the full list of items, or only a general title, requiring many sheets of form 56 for the items record. Forms 56 are filled by the order superintendent, and sent with

Form 59		B
	Requisition No. <u>40518</u>	
	For Job No. _____	Date when ordered _____ 190
	Specification No. _____	Date when wanted _____ 190
Date when delivered.		Foreman.
<p>This Requisition is to be made out by the Foreman, approved by the Superintendent, deducted from the box slips, and the prices for the articles carried out on this Requisition by the Storekeeper, who will deliver the articles; then the result is to be posted to the Job Cost Sheet by the Bookkeeper.</p>		

FORM 59. FACTORY REQUISITION ON WAREHOUSE.
First part, to be joined to second part along bottom line.

related form 54 to the box office, whence forms 54D and 56 are sent to the warehouseman, who ships the order as directed, noting particulars on form 57, which is printed on the backs of forms 54C, 54D, 54E and 56 alike. Form 56 is merely a sur-

face amplification of form 54, and has the same handling and functions as form 54.

The receipt of forms 54 and 56 by the warehouseman authorizes the shipment which he makes on the date required by the route fixed by usage, by the customer or by the order superintendent. Upon shipment, the warehouseman notes items on form 55, printed on back of form 54D.

Form 57. Back of form 56. Printed in copying ink. Filled by the warehouseman and sent to the factory accountant for factory prices, and then sent to the Hunt Company's chief accountant, who makes the invoice from factory prices on the front side, form 56, as extended by the factory accountant, and files forms 56 and 57, by gumming the sheet into the customer's order book. Form 56 is copied by the factory accountant in his letter-press copy book, which gives the factory a record of the shipment and item prices at factory rates. The text of form 57 is the same as that of form 55. Form 57 is not shown.

Form 58. Inspector's Certificate. Red tag. Size, $4\frac{3}{4}$ by $2\frac{3}{8}$ inches. It is attached to the article by the inspector, and remains with the article until shipment, when the tag is removed by the warehouseman and filed by him as proof of inspector's warrant of quality of shipment.

Form 59. Factory Requisition on Warehouse. Black print on yellow paper. Stub pad sheet, perforated on line A B, for separation. Size, $14\frac{3}{8}$ inches long by $5\frac{1}{4}$ inches high.

Filled by the works superintendent or foreman; stub and coupon bear the same serial number in red. The stub remains with the works superintendent.

THE WAREHOUSEMAN.

This important official occupies an office adjoining the telephone office at the works entrance, and has a stenographer and typewriter assistant, and has as mechanical aids, besides his typewriter, a stencil-cutting machine.

The warehouseman has charge of all finished factory product, is the shipping clerk and route clerk, and collects and stores the finished product from all factory departments. He has a varying force of from four to fifteen laborers employed in handling material, and has charge of the company's trucks and stables.

The warehouseman makes all shipments and all stores disbursements on authority of forms 54D, RA, and 56, which are sent to him from the box office or by the rope keeper.

Form 66, a card list of package contents is filled by the warehouseman in duplicate for every package containing more than one kind or description of material. Where a package contains only one item, form 66 is not used. Form 66, being a heavy card, cannot be filled in carbon duplicate, and the two forms 66 are filled in manuscript, one being copied from the other. The warehouseman keeps one copy of form 66, and sends the other in the box with the shipment. The heavy manila card will not absorb oil, and is therefore used instead of a thin paper.

The warehouseman advises the consignee of every shipment made by him by means of a carbon duplicate communication made on the C. W. Hunt Co.'s letter head sheets; this communication specifies the shipment routing, which is designated by the consignee or by the warehouseman, and describes each box and package of the shipment, with detail of contents corresponding to the fillings of forms 66, which are sent inside the packages. As stated, the warehouseman keeps duplicates of forms 66, and he also files a letter-press copy of his detailed advices of shipment to the consignee, in his office letter press book, thus preserving the record in his own keeping, and sends one copy of his detail of shipment to the consignee, and the other copy to the executive engineer.

Before noon of each day the warehouseman delivers to the executive engineer (1) copies of his letters of advices to consignees, (2) all of forms 54D, and (3) all of forms 56, satisfied by the shipments of the current day, which can be specified, commonly, at eleven in the forenoon for the whole day.

In point of fact, in addition to the Hunt forms shown, the warehouseman keeps private records as follows:

(1) A detail record of the net weights of all packages shipped; this record is in book form, and is a day book record of package weights and marks.

(2) A card-index stores ledger of finished stores, which he checks by actual count and survey once in 30 or 60 days.

Rough stores are delivered to the factory by water, at the Hunt dock, by truck from New York, and by rail, and the ware-

houseman transports these rough stores to their proper factory destinations, he being notified of the expected arrival by the receipt of the upper part of form 32, carbon duplicate, sent to the warehouseman by the purchase agent at the time of filling form 32.

Forms 37 are also sent by the purchase agent to the warehouseman, who is thus notified to send a truck to the supplier.

The warehouseman dates all communications received by him, of whatever nature, with the day, hour and minute of reception; this rule is rigidly applied, and avoids all question as to the date of his notification.

All freight bills are sent to the warehouseman, who vises them, and if the rating is correct, sends them to the factory accountant.

THE STOREKEEPER.

The storekeeper handles, stores and disburses all rough stores, and cuts bars to suit bill of material and piece-tag specifications.

The forms handled by the storekeeper are the top part of form 33, purchase order notification; form 22, miscellaneous bill of material; form 23, castings bill of material; and form 24, the piece tag.

Materials-received invoices are sent by the purchase agent to the storekeeper, and by him checked to material on form 33, and then form 33 and invoice are sent to the box office for ledger entry, with weights.

The storekeeper receives one copy of each bill of material, forms 22 and 23, and all piece tags, which are filled under orders of the executive engineer, and wires the piece tags to the material specified, and piles the tagged material on factory cars, which transport it to proper departments by electric traction under orders of the yard foreman. The storekeeper sends the satisfied bills of material, forms 22 and 23, to the box office.

The brass castings are made in a factory department by sending a bill of material, form 23, from the executive engineer, through the order superintendent, in duplicate to the pattern maker and the storekeeper. The pattern maker sends patterns to the brass foundry, which sends castings to the storekeeper and

returns patterns to the pattern maker. The storekeeper checks and weighs the castings into his stores and sends form 23 to the box office.

Upon requisition from the works superintendent or a foreman, the storekeeper may add to a form 22 or 23, and fill a corresponding piece tag himself and attach it to material and send it into the factory, all forms 22 and 23 being sent by the storekeeper to the box office.

The storekeeper records all weights on either invoices or bills of material, and all numbers.

The storekeeper's force is one laborer and one boy. He makes no records which he retains, and does not note his disbursements except by checking form 22 and 23. The box office keeps the rough-stores ledger.

THE PUBLICATION DEPARTMENT.

This department has charge of all printed matter, stationery, cuts and advertising. The forms include card index ledgers.

Form 60. Departmental requisition on the "Publication Department" for stationery. Black print on white paper. Size, 6 inches long by $4\frac{5}{8}$ inches high. Not engraved.

Form 61. Card Index of Cuts for Publication. Stiff white card; printed all in black. Size, 5 by 3 inches. The abbreviation "O" stands for "original," "E" for "electrotype." This is a card index of cuts sent out by the publication department. Filled and kept by the publication department.

Form 62. Back of form 61. The "O or E" column heading signifies "original" or "electrotype."

Form 63. Publication Department Stores Index Card. White, stiff card; ruled in red, blue and purple; printed in black. Size, 5 by 3 inches. Filled and filed by the publication department.

Form 64. Back of form 63. Continues the "Quantities used" record, but is without the list of particulars spaces which head form 63. Not engraved.

Form 64A. Advertising Record Index Card. White, stiff card; printed all in black. Size, 5 by 3 inches. Note the 5-week spaces for each month. This comprehensive and convenient form

replaces a large sheet form, and notes all important advertising events. See also form 64B.

Cut Number _____ Draw, O. _____ E. _____ On hand, O. _____ E. _____
Made by _____ Kind _____ Size _____
Original _____
Subject _____
Remarks _____

Received _____

Costs: { Artist's Work _____
Engraving _____
Electro _____

C. W. Hunt Company.

Form 61

FORM 61. CUTS-FOR-PUBLICATION CARD. FRONT.

Form 64B. Back of form 64A. Reading Notice Record.
Ruled in blue and red.

[illegible]

FORM 62. CUTS-FOR-PUBLICATION CARD. BACK.

It is of importance to the advertiser to note the attention given in the reading space of his advertising medium, and this

record is most conveniently kept on the back of the advertising record card. These two forms, 64A, 64B, front and back of the same card, make a very suitable combination for noting all important advertising events.

C. W. HUNT COMPANY, Publication Dept. - Stationery Record:															Form 63
ARTICLE															
QUAN.	COST				WHEN REC'D				PURCH. OF				ELECT. NOT ELECT.		
QUANTITIES USED QUAN. DEPT.	DOST.														
DATE															

(CONTINUED ON OTHER SIDE)

FORM 63. PUBLICATION DEPARTMENT STORES CARD.

C. W. HUNT COMPANY. ADVERTISING RECORD.														Form 64A	
Medium															
Space Schedule.		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
Month	Date	Ad.No.	Date	Ad.No.	Date	Ad.No.	Date	Ad.No.	Date	Ad.No.	Date	Ad.No.	Date of Bill	Amount	Date of O. K.
Jan.															
Feb.															
Mar.															
April															
May															
June															
July															
Aug.															
Sept.															
Oct.															
Nov.															
Dec.															
Regular Space		Beginning													
Rate		Discount													
Payable		Expiring													
		How Invested													

FORM 64A. ADVERTISING RECORD.

Form 64C. Subscription Record. White, stiff filing card, 5 by 3 inches. Filled and filed by the publication department, used for periodicals not carrying advertisement.

Form 65. Publication Department Memorandum. Thin buff sheet, printed in black. Size, 6 inches long by 5½ inches high. Not engraved.

[illegible]

FORM 64B. BACK OF 64A. READING-NOTICE RECORD.

Form 64C

C. W. Hunt Company.

Subscription Record.

Publication		
Address		
When Pub.	Rate	Ordered
Began	Expired	
Date of Bill	Amount	Account

FORM 64C. SUBSCRIPTION RECORD.

Form 66. Package Contents List. Stiff manila card; printed all in black. Size, 5¾ inches long by 4¾ inches wide. Filled by the warehouseman and sent with package. See also form 85.

For _____ _____ _____ _____	From C. W. HUNT COMPANY, 45 Broadway, New York. Manufactory: WEST NEW BRIGHTON, STATEN ISLAND, N. Y.
This package contains: _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	
Packed by _____ Date _____ 190____ Shop Order No. _____ Reference No. _____ _____ _____	
Form 66	

FORM 66. PACKAGE CONTENTS.

Form 67. Inventory Sheet. White paper; black print; red and blue ruling. Size, 14 inches long by $8\frac{1}{2}$ inches high.

OUTSIDE WORK.

Form 68. Erector's Expense Report. White paper. Printed on both sides in black. Front ruled blue and red. Size, 11 inches long by $8\frac{1}{2}$ inches high.

Filled by the erector, and sent to the executive engineer, and passed through the hands of the factory accountant to the controller.

Form 69. Back of form 68.

Form 70. Shop Order. Yellow paper; printed in black. Size, 8 by 8 inches.

Filled by the order superintendent on orders from the executive engineer, order number given, and then form 70 is given to the workman, who carries it with him, and also carries blank forms 72 with him, which he fills and sends weekly to the factory accountant, to whom he sends form 70 with the final filled form

Form 68

I HEREBY CERTIFY THAT THE FOLLOWING IS A TRUE STATEMENT OF MY MOVEMENTS AND EXPENSES ALL
IN THE INTEREST OF THE C. W. HUNT COMPANY, DURING THE WEEK ENDING _____ 190____.

SIGNATURE: _____

DETAILED EXPLANATION OF MOVEMENTS AND EXPENSES FOR WHICH VOUCHERS ARE ATTACHED FOR ALL PURCHASES, LABOR-HIRE, AND HOTEL EXPENSES	WEEK ENDING _____ 190____							TOTAL
	SUN.	MON.	TUES.	WED.	THUR.	FRI.	SAT.	
CASH BALANCE BROUGHT FORWARD								
CASH RECEIVED								
RAILWAY FARE FROM _____ TO _____								
RAILWAY FARE FROM _____ TO _____								
SLEEPER FROM _____ TO _____								
SLEEPER FROM _____ TO _____								
DINING CAR FROM _____ TO _____								
DINING CAR FROM _____ TO _____								
BUS, CAB, CAR FARE, AT _____								
BUS, CAB, CAR FARE, AT _____								
TELEGRAPH _____								
TELEPHONE _____								
POSTAGE _____								
LIVING EXPENSES _____ HOTEL, AT _____								
LIVING EXPENSES _____ HOTEL, AT _____								
LIVING EXPENSES _____ RESTAURANT, AT _____								
INCIDENTAL PERSONAL EXPENSES _____								
LABOR-HIRE FOR WHICH RECEIPTS ARE ATTACHED _____								
PURCHASES OF MATERIAL, ETC., FOR WHICH BILLS ARE ATTACHED _____								
BALANCE TO COMPANY'S CREDIT _____								
TOTAL								

FORM 68. ERECTOR'S EXPENSE REPORT. FRONT.

INSTRUCTIONS.

It is the purpose of the C. W. HUNT COMPANY to maintain its representatives abroad as well as they live at home for which in return the Company expects a due measure of diligence in the performance of duties, a keen regard for the Company's best interests and, that the Company may profit by its enterprise, prompt and clear reports of movements and expenses.

C. W. HUNT CO.

WEST NEW BRIGHTON, NEW YORK

EXPENSE ACCOUNT.

DURING THE WEEK ENDING

190

FORWARDED.

EXECUTIVE ENGINEER

CHECKED.

M. W. C. ACCOUNTANT.

RATIFIED.

CONTROLLER

ENTERED BK. FOLIO

FILED

190

The official week ends on Saturday hence this report must be completed and mailed to the Company, addressed to the Home Office, not later than 12 o'clock M. the following Sunday. Receipted bills for purchases, labor and living expenses must be attached to this report, otherwise it cannot be audited.

ERECTOR'S EXPENSE REPORT.

FORM 69. ERECTOR'S EXPENSE REPORT. BACK.

Form 70
SHOP ORDER NUMBER

C.W. HUNT COMPANY ORDER CARD, M.O.
TIME LIMITED.

Bookkeepers will check here when the job cards and requisition have been assembled and entered on cost sheets.
STOCK REQUISITION NOTE CO.

DATE WHEN ISSUED 190

SHOP NAME OF ARTICLE DEPARTMENT

Job cards with the following letters have been issued on this order.

Contract price for the job.	WORKMAN'S NUMBER	LETTER ON THE JOB CARD	CHECK WHEN JOB CARD IS MADE OUT	CHECK WHEN JOB IS COMPLETED	Description of the work to be done	Number of the Requisition issued for Materials
		A				
		B				
		C				
		D				
		E				
		F				No. of Stores Returns Note
		G				
		H				
		I				
		J				
		K				
		L				
		M				
		N				

Foreman will check here when all the job cards necessary to complete the order are given out.

Superintendent will punch here when this card is sent to the shop.

Foreman will check here when all the job cards are complete and handed in.

Specification No.

Form 72

OUTWORK TIME VOUCHER.

C. W. HUNT COMPANY.

For week ending

SHOP ORDER NO.

Card Letter.....

Entered on Time Book by.....

" " Pay Sheet by.....

" " Cost Ledger by.....

Charge.....

Description of Work Done.	Workman's Name	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total

NOTE.—Should a workman remain out until the following week he will mail this report to the works as soon as the week's work is closed. Under no circumstances should it be delayed longer than Sunday night.

Approved.....

Supt.

Foreman.....

Form 73

Dep. Div. No. _____ C. W. HUNT COMPANY. Vols. _____

APPROPRIATIONS OF TIME AND EXPENSES.

NOTE.—In addition to appropriating or allocating their Expenses under the different Merchandise headings, Salesmen will please appropriate their time in the same way. The calculations will be made at the Home Office. Engineers and Draughtsmen will appropriate their expenses only on these sheets, separate sheets being provided for their time.

DAYS.	"A"	"B"	"C"	Repn.	Automobile.	Household and Sundry.	TOTAL.	
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Dollars.	Cents.
Sunday.								
Monday.								
Tuesday.								
Wednesday.								
Thursday.								
Friday.								
Saturday.								
Total Expenses.	\$	\$	\$	\$	\$	\$	\$	
Time Employed.	Days	Min.	Days	Min.	Days	Min.	Days	Min.
Amount of Salary or Compensation.	\$	\$	\$	\$	\$	\$	\$	

Calculations made by _____ Checked by _____

Approved by _____

FORM 73. SALESMEN'S REPORT OF TIME AND EXPENSES.

72. Form 72 is then filed by the factory accountant in form 25, order cost envelope.

Form 72. Weekly Report from Outside Workman. White

paper; printed in black. Size, $9\frac{7}{8}$ by 5 inches. Filled by the workman, sent to the works manager, approved, and sent by him to the factory accountant. Finally filed in form 25.

Form 73. Salesmen's time and expense report, weekly form. Black print and ruling on white paper. Size, $8\frac{1}{4}$ inches long by $10\frac{7}{8}$ inches high.

APPLICANT FOR EMPLOYMENT TO C. W. HUNT COMPANY.			
Name	Age	Date	
Residence, Street and No.	City	State	
Place of Birth	Citizen of		
Married	Wife living	Number of Children	
Trade	Specialty		
Last Employer	Length of Last Employment		
Reason for Leaving			
Member of	Union. Introduced by		
Engaged by	Foreman at	per hour	Date
Remarks			
			Form 74

FORM 74. WORKMAN'S RECORD.

Filled by the salesman or engineer, and sent to the counting room direct or through the hands of the executive engineer.

Form 74. Workman's Record. White, stiff index card. Size, 5 by 3 inches. Filled and filed by the paymaster.

TIME AND JOB CARDS.

Form 75. Workman's Job Time Card. Pale blue thin sheet; printed all in black. Size, $5\frac{1}{8}$ inches long by 3 inches high. Job card at day rate.

Filled by the foreman. The workmen make no records in the Hunt factory. The foreman, in case of interruption, must note the time of stopping and re-starting, and must check the department in department list. These forms are sent to the factory accountant each morning, compared with the clock time card record, and then sorted to the job number, and finally placed in a job order envelope.

Form 76. Job Card. Pale yellow, black print. Same, except color, as form 75. Not engraved.

Form 77. Time Card. Light green thin paper; printed in black. Size, 5 by 3 inches.

Form 75

Form F
JOB CARD

1 This card must be filled in entirely by a foreman or his clerk. 2 The card is to be given to the workman with the job, and checked by the foreman at each interruption or resumption of the job. 3 A carbon duplicate of the card is to be sent simultaneously to H. M. C. office for posting of rates. 4 The workman is to return his card to the foreman for filing immediately on completion of the job.

Shop Order No.	Drawing Number	Piece Number	No. of Pos. in Job	Operation
Dept. Number	Machine Number	Workman's No.	Workman's Name	Rate
Time Started	DATE	HOUR	DATE	HOUR
Time Interrupted				
Time Resumed				
Time Finished				

INDEX TO DEPARTMENT NUMBERS

NO.	DEPARTMENT	NO.	DEPARTMENT	NO.	DEPARTMENT	NO.	DEPARTMENT
1	Stores	8	Benchers	15	Flanging	22	Shipping
2	Cutting Off	9	Planer.	16	Setting Up	23	
3	Lathes & Screwing	10	Erecting Bench	17	Painting	24	
4	Milling & Shapers	11	Forge	18	Patterns	25	
5	Boring Mill G'r C't'r	12	Punch & Shear	19	Brass Foundry	26	
6	Turret Lathes	13	Saws	20	Wood	27	
7	Drills	14	Riveting	21	Warehouse	28	

FORM 75. JOB CARD AT DAY RATE.

Form 77

Form F
TIME CARD

ALL WORKMEN ARE ENGAGED BY THE HOUR

SHOP ORDER NO.	DRAWING NO.	PIECE NO.	THIS COLUMN TO BE FILLED IN BY H. M. C. OFFICE	
OPERATION	DEPT.	MACHINE NO.	MONEY VALUE	
WORKMAN'S NUMBER	DATE	HOURS	QUARTERS	
WORKMAN'S NAME				
REMARKS				
TIME O. K. (BY FOREMAN)				
TOTAL TIME FOR DAY		HOURS	QUARTERS	

One of these forms must be filled out for each separate job upon which a workman is employed on any day. Pay will otherwise be withheld. The forms are to be handed in every night to timekeeper.

FORM 77. TIME CARD.

Form 78. Time Card. Black print on white paper. Same text as 77. Not engraved.

Form 79. Workmen's Supply Record Slip. White paper, black print. Size, $3\frac{1}{2}$ by $5\frac{1}{2}$ inches.

Filled by the foreman, and taken by the workman to the tool room; sent by the tool room to the factory accountant, charged to expense, and filed.

Forms 80 and 81. Front and back of time clock card. Size,

Form 79	
C. W. HUNT COMPANY.	
Supply order for.....Dept.	
Month.....	Day.....
. Alcohol Brass Rod " Sheet Belt Lace " Hooks Belt Dressing Brush, Bench " Paint Bone Dust Candles Drill Emery Cloth " Paper Sand " File File Handle Hammer " Oil Kerosene " Sperm " Machine " Lard " Cylinder Oil Can Piston Packing Screws Solder Taps Waste Wax Wire
Quantity.....	
Description.....	
For employee.....	
No.....	Foreman

FORM 79. WORKMEN'S SUPPLY RECORD SLIP.

2 11-16 by 7 inches high. See Potter and Johnston's forms for this well known card, front and back.

Draftsmen as well as workmen record entering and leaving time on clock-printed cards, from which the pay roll is made up.

Form 82. Outside workman's time and expense record sheet for short job. Pale blue thin paper; black print. Size, $5\frac{3}{8}$ inches long by $8\frac{3}{8}$ inches high.

Form 82

EMPLOYEE'S TICKET. SHOP ORDER NO.

C. W. HUNT COMPANY,

WEST NEW BRIGHTON, S. I.

Name Date 190.....

Employed at

from M. to M.

A Total of Hours.

To insure payment this slip must be filled out and handed or
mailed to the Foreman each day.

EXPENSES.	\$	Cts.
FARES TO
LODGING
BREAKFAST
DINNER
SUPPER
HELP.		
FOR ROPE
FOR TRACK
FOR CARS
FOR CASTINGS
OTHER ARTICLES
TOTAL

The above time and expenses are correct,

.....
Foreman.

Countersigned by

.....
Superintendent.

410 *FACTORY MANAGER AND ACCOUNTANT.*

Filled by the workman, certified by the foreman, countersigned by the works superintendent, and sent to the factory accountant.

Form 83. Manila tag, printed in red. Size, $4\frac{7}{8}$ by $2\frac{3}{8}$ inches. Attached to any questionable material by receiving clerk, to identify material held pending inquiry.

Form 83
Goods Received Information Wanted. Note No.

Date Received
Messenger

Received Via
Freight

" From
Express

C. W. HUNT COMPANY,
WEST NEW BRIGHTON, N. Y.

FORM 83. TAG FOR MATERIAL ABOUT WHICH INFORMATION IS WANTED.

C. W. HUNT COMPANY.

West New Brighton, N. Y., 190

Controller: *Please make checks for account of "H. M. C." as follows:*

In favor of at \$

" " " "

" " " "

For Petty Cash

Signed

Approved

H. M. C. Hunt Company.

Executive Engineer.

FORM 84. PETTY-CASH REQUISITION.

Form 84. Petty cash or outside labor payment request form. Black print on white paper. Size, $8\frac{3}{8}$ by $4\frac{1}{2}$ inches.

Filled by the factory accountant, approved by the executive engineer, and sent to the controller. The factory accountant pays

small sums, freight and outside work expenses and so on, obtaining funds on this request form.

Form 85. Package List. This form is substantially the same size and text as form 66, stiff manila card. Form 85 is a thin pink slip, printed all in black. Size, $5\frac{5}{8}$ inches long by $4\frac{3}{4}$

Form 86

West New Brighton, N. Y., _____ 190

Please pay \$ _____ Freight
Express to _____

being amount of charge on _____

Received this day from _____

Receiving Clerk.

FORM 86. REQUISITION FOR FREIGHT AND EXPRESS CHARGES.

inches high. Filled by the packer, and sent with package. Little used. Not engraved.

Form 86. Freight Slip. Printed in copying ink on white paper. Size, 5 inches long by $5\frac{1}{2}$ inches high. Filled by the receiving clerk and sent to the factory accountant.

THE FACTORY ACCOUNTANT.

The factory accountant's office joins the office of the rough-stores keeper. The factory accountant makes up the manuscript pay roll, charges the order numbers with their labor debits, has charge of the petty cash from which minor factory charges are paid, and keeps the envelopes, form 25, which finally are made to contain the history and the costs of all order productions.

The factory accountant handles forms as follows:

Form RA. The total rope weight, is made up at the month's end, and the rope sales charged with a fixed labor percentage per 100 pounds, which is a credit to the Hunt Manufacturing Co., form RA being sent to the chief accountant of the C. W. Hunt Company as the Hunt Manufacturing Company's credit voucher for labor expenditure in shipping rope.

Form 7. See description.

Form 8. As occasion requires.

Form 12. See description.

Form 13. See description.

Form 22. The bill of material is received from the box office, and factory piece-prices are entered against each item, the total being charged against the form 22 order number, on form 22 itself, front or back, wherever room can be found, and, also, the labor cost as shown by the time cards is added, for the production of all items specified on the particular form 22, and then form 22 is filed in form 25, which see. Thus, form 22 is a cost record of its items-production cost, and the total production cost at factory prices, and the total of all form-22 charges is the total cost of the order number which these forms bear.

Form 23. Comes to the factory accountant from box office, and gets the same treatment as form 22.

Form 25. See description.

Form 40 is sent by the order superintendent to the factory accountant, who makes corresponding credit to the returner.

Form 54B is sent by the order superintendent to the factory accountant, by him entered in sales-order book, and then gummed in the factory-requisition file book.

Form 54C is sent by the warehouseman to the factory accountant, who makes extensions at factory prices, and sends form 54C to the controller. All piece prices.

Form 54D goes from the box office to the factory accountant, who extends factory prices, and files this form in Hunt Manufacturing Company's sales book.

Form 56. Supplemental bill of partial shipment. Many of the sales have more items than can be specified on form 54, and there are also many partial shipments; all such are itemized on form 56, which is filled by the factory accountant, copied in his letter press book, and sent to the controller.

Form 59 is sent to the factory accountant from the box office, filled by any department foreman, and the total charged to factory expense account. Form 59 is filed in the factory accountant's file. It is used for small charges only.

Form 60. See description.

Form 67. See description.

Form 68 is sent by the outside foreman, filled, to the executive engineer, by whom it is vised and sent to the factory accountant and is filed by the latter as an outside factory expense memorandum.

Form 69, back of form 68. See description.

Form 70. Front. Shop order for outside jobs. It is filled by the order superintendent from the executive engineer's instructions, no drawings being used with this form, and given by the executive engineer to the workman who does the work. On completion of the job, form 70 is returned to the executive engineer, vised by him, and sent to the factory accountant, through the works superintendent, who vises form 70 and certifies it with his punch. The factory accountant stamps form 70 "completed," and files it. This is a mere memorandum of performance and completion. No charges are made from form 70. Charges for job recorded on form 70 are charged on form 68 for expense, and on form 72 for labor time.

Form 72, out-work time voucher, is filled by outside workmen, and sent to the executive engineer, vised by him, and sent to the factory accountant, who then fills form 54C, which is copied on form 54D, the invoice number is added, and form 54C is sent to the controller, and form 54D is gummed into the factory accountant's sales-record book.

Form 74. See description.

Forms 75 and 76 are filled by the foreman and sent to the

factory accountant, who is paymaster, as a memorandum of the workman's performance, and filed in form 25.

Form 77, contract time card, is filled by the workman, and handled and filed the same as form 75. The "money value" space is filled by the factory accountant and checked by clock ticket, credited on the pay roll and filed in form 25.

Form 78 is filled by the workman, vised and checked by the foreman, sent to the factory accountant, credited on the pay roll and filed in form 25.

Forms 80 and 81, time-clock workman's time records, are collected by the telephone clerk Saturday nights, and sent to the factory accountant. The card boxes are filled by the telephone clerk. The time-card totals are checked by the clock cards, which are then filed by the factory accountant.

Form 82, minor expense voucher, is used by any foreman, principally by the shipping clerk, and sent to the factory accountant, who makes a corresponding charge and files form 82 as his voucher for petty cash disbursements.

Form 84, factory accountant's funds-requisition on the controller, is filled by the factory accountant, who charges "petty cash" to the factory cash account, and sends form 84 to the controller. The previous items are specific charges, and are entered against proper order numbers by the factory accountant.

Form 86, filled by the storekeeper, is a requisition for cash express charges, and is sent to the factory accountant, who credits petty cash with amount.

The factory accountant has one assistant, two time-card handlers, one cost clerk, and one messenger boy, five subordinates in all. His mechanical aids are one typewriter and one comptometer.

THE ORDER SUPERINTENDENT, THE ORDER CLERK AND THE PURCHASE AGENT.

The factory departments are under the direction of the works superintendent, who receives his orders for production from the executive engineer through the order superintendent, who acts in response to the sales order delivered to him through the sales clerk, and the factory supplies and rough stores are procured through the purchase agent.

The order superintendent's office is near the executive engineer's desk in the drawing room, and adjoins the expanded-metal-partitioned enclosure occupied by the librarian; these three officials, the executive engineer, the order superintendent and the librarian are intimately related by their duties, and are located at the entrance of the drawing room, the purchase agent's desk being on the drawing room floor at the eastern end, and the sales agent's desk being close at hand.

The purchase agent and the order clerk are intimately associated, as purchases must often be made with direct reference to sales orders, made on forms 54. The drawing-room building is a single-floor brick structure, with an iron roof, glazed on the north slope, and is extremely well lighted. The order superintendent has two assistants, a young man, and a woman who operates a typewriter. The librarian has one assistant, and there are two youths in addition who are employed principally in the production and handling of prints and messages.

The duties of the order superintendent are purely clerical, as are those of the purchase agent and the order clerk. The purchase agent buys as he is directed, and the order clerk translates the customer's order into factory terms and fills forms 54 to 54E, inclusive, from his book to sales form blanks. There are six blanks, one white, one pink, one green and three yellow, all bearing the same serial order number, for each sale. The order clerk keeps the white form, 54, for his own record, and sends the remaining five sales forms to the order superintendent, who so distributes them as to set the productive agencies of the factory in motion, and cause the order to be finally shipped to the customer. The sales-form book pad is punched for the book-type-writer register pins, and the six sales forms are filled in carbon duplicate at one writing by the sales agent's typewriter.

The duties and functions of the preliminary engineer and the executive engineer, who are the chief officials in the drawing-room, have been previously pointed out in the interpretation of the system charts. In brief, the production routine in the drawing room begins with the sending of the sales order from the order clerk to the executive engineer, who causes the filling out of the bills of material and the piece tags by the draftsmen, after the drawings are ready. The executive engineer of course

directs the preparation of drawings where they are to be made. The bills of material must be filled in case the sales order cannot be filled by the warehouseman from finished stores. The bills of material and piece tags go to the order superintendent, who procures the related blue prints from the librarian, and places the blue prints for the order, which are one size only, 11½ by 18 inches, in a stout manila envelope with the piece tags and the requisite copies of the bills of material, and sends the envelope to the works superintendent, which ends the duties of the order superintendent, so far as the particular order is concerned.

Five copies of each bill of material are required, and these are made by use of the copying pad, a shallow tray filled with a peculiar plastic composition which has a smooth face and will take copying ink from a document. The work done on the Hunt copying pad is extremely good, and the pad is therefore described in detail.

THE HUNT COPYING PAD.

This is a wooden tray an inch or so in depth, and large enough to more than take the largest sheet to be copied; in this instance about 2½ by 3½ feet, set at working height, and filled about full of a composition thoroughly mixed, dry, of 5 pounds of baryta, 2 pounds kaolin and 2½ ounces dextrine, ground in a coffee mill or passed through rolls, to pulverize small lumps and make a thoroughly homogeneous mixture. After grinding, add 1½ pounds of glycerine and 10 ounces of water, knead thoroughly and then fill the tray up even with the sides, making the pad material about 1 inch thick. This makes a dense, slightly-plastic mass, having a sufficiently firm top working surface. To obtain copies of the bills of material, or of the preliminary drawings, which are also made in copying inks and are copied by the pad process, the originals are laid face down on the pad, and rubbed on the back with a spatula or paint knife, which causes the transfer of the copying ink to the pad face, in reverse of course. Before the original bill of material is stripped from the pad, to which it very slightly adheres, guide pins are stuck into the pad at the sheet edges; as all of the form blanks are the same size these guide pins give an accurate register to the copies, which are produced by laying blanks face down on the pad be-

tween the pins, after the original has been removed, and rubbing the backs of the blanks with the spatula, as at first. By this method copies of large drawings are produced rapidly, perfectly, and with a very small plant outlay.

The composition of the "pad" is of the greatest importance in this method of copying. The pad must take the copying ink from the original readily, and must hold it tenaciously, but must not absorb the ink, because if the ink penetrates downward the pad surface cannot be perfectly cleaned after use in copying one drawing. This specified pad composition is the result of many trials made by Mr. C. W. Hunt personally, and works perfectly, holding the ink firmly, and yet not absorbing it in any degree, and being very easily and perfectly cleaned by wiping with a damp cloth. This pad dries very slowly, and remains in working condition for about two months, when it must be removed from the tray and reground and be suitably tempered by additions of water and glycerine.

A vast amount of labor has been expended on the Hunt Company forms, to produce blanks suited to all the details of a widely diversified and extended business. The endeavor has been to reduce chances of doubt, error and confusion, by supplying an appropriate form blank to meet every possible requirement, and to meet all conditions in the plainest and most direct and obvious manner. No attempts are shown in these forms to avoid clerical labor. Certainty of record, and certainty of the information carried by the record, have been placed before all other considerations, with the result of a very large aggregation of form blanks, many of them seemingly unimportant, but of which none can be discarded without leaving more than is desirable to the resources and discretion of minor officials.

The rapid and steady growth of the C. W. Hunt Company, and the high favor in which its product is held, will give all the Hunt Company's factory practice weight in the estimation of factory managers at large.

INDEX.

Accident report (Link-Belt Form 117)	85, 86	Blue print department—Link-Belt Co.'s photograph and (Plan)	26
Accountant, Factory (Hunt Co.) ..	412	Boiler manufacturing (Bigelow Co.)	101
Account books (Potter and Johnston)	237	Boiler-shop day book (Bigelow Co.)	112
Accounting—Factory	12	Bolts, screws and steel bars box slip (Hunt Form 53)	381
Accounting forms (Cottrell Co.)	206, 225	Books—Bound (Potter and Johnston)	237
Acknowledgment of order (Hunt Form 6)	340	Box for stores slips (Hunt Figure 49)	378
Address slip (Hunt Form 7)	340	Box office	
Advertising record (Hunt Form 64 A)	397	Hunt Co	377
Authority—Chart of (Cottrell Co.)	116, 117	Hunt System Chart No. 6	331
Balance sheet—Daily (Cottrell Form 53)	211	Sales order copy (Hunt Forms 54 C and 55)	386, 387
Bars, screws and bolts box slip (Hunt Form 53)	381	Box slips (Hunt Forms 50, 51, 52 and 53)	380, 381
Baskets—"In" and "out" (Cottrell Co.)	123	Brass furnace weekly foundry report (Cottrell Form 47) ..	205
Beaman and Smith system	285	Buildings	
Benefit society (Link-Belt Co.) ..	28, 84, 87	Cottrell Co.'s (Plan)	115
Bigelow Company	101	Link-Belt Co.'s (Plan)	25
Billhead (Potter and Johnston) ..	264	Cabinet—Stores-ledger (Wells Brothers Co.)	284
Bill of Lading (Cottrell Co.)	220	Calder—John	320
<i>See also</i> Invoice		Caller's slip	
Bill of material		Cottrell Form 71	227
Link-Belt Form 106	32, 76, 82	Hunt Form 1	338
Link-Belt Form 109	82	Card cabinet—Stores-ledger (Wells Brothers Co.)	284
Miscellaneous (Hunt Form 22)	354, 355	Card index—Wheel (Link-Belt Form 83)	63
Pattern and casting (Hunt Form 23)	353	Card record of principal production (Cottrell Form 54)	212
Bills and specie specification and list for pay roll (Cottrell Forms 43 D and 43 E)	202	Card tray (Cottrell Co.)	122, 161
Bills—Request for duplicate (Hunt Form 35)	362	Case back (Hunt Form 10) ..	342
Bin card (Hunt Form 41)	369	Case for shop order (Wells Brothers Co.)	305
Blue print		Case system (Hunt Co.)	342
Cottrell drawings and	128	Cash received statement (Cottrell Form 52)	210
Issued (Hunt Form 16)	348	Casting and pattern bill of material (Hunt Form 23)	353
Out (Hunt Form 19)	350		
Requisition (Hunt Form 18) ..	349		
<i>See also</i> Print			

- Castings list
 Cottrell Form 11 A...128, 147, 148
 Cottrell Form 21..... 179
 Potter and Johnston Form 1.. 239
 Castings requisition (Cottrell Form 16 A).....149, 166
 Certification for materials received (Potter and Johnston Form 3) 244
 Chains (Link-Belt) 29
 Change in day rate of wages (Cottrell Form 41) 195
 Charge sheet—Tool-room (Bigelow Form 1) 104
 Chart of authority (Cottrell Co.) 116, 117
 Charts—System (Hunt Co.)..... 320
 Check register (Cottrell Form 7) 141
 Chain slip for errors in wages (Cottrell Form 42)..... 196
 Clock-recorder time card (Potter and Johnston Forms 4 and 4 A) 246
 Coal consumption report (Potter and Johnston) 268
 Collective component tracing and locating (Cottrell Form 14) . 156
 Color scheme of component tags.. (Link-Belt) 30
 Complex forms—Many simple aids preferred to fewer..... 17
 Component costs—Principal order (Cottrell Form 14 A)... 157
 Component lists (Cottrell Co.).. 130
 Components—Red line S. K. (Cottrell Co.) 151
 Component tags
 Color scheme of (Link-Belt Co.) 30
 Link-Belt Form 103.....71, 72, 74
 Component tracing (Cottrell Co.) 120
 Component transfer — Actual (Cottrell Co.) 163
 Copying book—Letter press (Potter and Johnston) 253
 Copying pad (Hunt Co.)..... 416
 Correspondence
 Cottrell Co. 183
 Departmental (Cottrell Form 10) 145
 Hunt Co. 337
 Receipt (Cottrell Form 70).... 226
 Rubber stamps (Cottrell Forms 33, 33 A and 33 B)..183, 184, 185
 Cost card
 Cottrell Form 18. 169
 Cottrell Form 58..... 218
 Rough stores (Hunt Form 44). 372
 Cost card
 Finished stores (Hunt Form 46) 374
 Silent chain wheel (Link-Belt Form 155) 95
 Cost finding 8
 Economic functions of..... 18
 Importance of 13
 Cost reduction—Necessity for... 21
 Cost sheet
 Daily wages (Link-Belt Form 130)36, 89
 Order (Link - Belt obsolete Form 32)33, 52
 Order (Link - Belt obsolete Form 111)34, 83
 Cost statement (Cottrell Form 14 A) 157
 Cost-summary card (Cottrell Form 18) 169
 Cost system (Link-Belt)..... 31
 Cottrell and Sons' Company—C. B. 113
 Cottrell correspondence 183
 Cottrell Co.'s works (Plan).... 115
 Cottrell production orders..... 127
 Cottrell works — Glossary of terms used in the..... 123
 Credit memorandum
 Cottrell Co. 225
 Link-Belt Form 43..... 54
 Potter and Johnston..... 268
 Wells Form 23..... 310
 Customer's notification of acceptance of order (Hunt Form 54 A) 284
 Customer's record card (Wells Form 3) 282
 Cuts for publication (Hunt Forms 61 and 62) 396
 Cutting off bars..... 293
 Cutting tools (Potter and Johnston) 267
 C. W. Hunt Company 317
 Daily balance sheet (Cottrell Form 53) 211
 Daily report of outside agent (Hunt Form 8)..... 340
 Daily time card—Machine-shop (Bigelow Co.) 107
 Daily wages cost sheet (Link-Belt Form 130)36, 89
 Damage report (Link-Belt Form 27) 48
 Dating stamp
 Cottrell Co. 184
 Print (Hunt Form 21) 351

- Datum line measurement system (Hunt Co.) 320
- Day rate of wages—Change in (Cottrell Form 41) 195
- Day rates—Wheel time card (Link-Belt Form 59)..... 59
- Day work and piece work (Potter and Johnston) 250
- Day work—Workman's time record at (Potter and Johnston Form 6) 249
- Decision deferred (Hunt Form 11) 343
- Deferred matters (Hunt Form 11) 343
- Delivery of material (Cottrell Form 11) 146
- Delivery to works on production orders—Sheet showing (Bigelow Form 4) 112
- Department
 Authorities and addresses (Hunt Forms 7 and 13)..... 344
- Communication envelope (Hunt Form 13) 344
- Correspondence, used as a production order (Cottrell Form 10) 145
- Operations (Link-Belt) 31
- Order on storeroom (Link-Belt Form 47) 55
- Pay roll distribution (Potter and Johnston Form 26)..... 272
- Purchase requisition (Cottrell Form 2) 132
- Stores requisition (Cottrell Form 11) 146
- Desk tops—Tabulation (Wells Brothers Co.) 286
- Detail-charges sheet (Bigelow Form 2) 105, 106
- Die manufacture 274
- Directions for shipping clerk (Cottrell Form 60) 221
- Discharge record—Employment and (Cottrell Form 40)..... 195
- Domestic shipment record card (Cottrell Form 64)..... 221
- Drafting. *See* Drawing
- Draughting. *See* Drawing
- Drawing and engineering preliminary time record (Hunt Form 14) 346
- Drawing index card—Preliminary (Hunt Form 15)..... 347
- Drawing room
 Hunt Co. forms..... 345
- Requisition (Link-Belt Form 124) 87
- Drawing room
 Time card (Link-Belt Form 152) 93
- Drawings and blue prints—Cottrell 128
- Drawings out (Hunt Form 17)..... 349
- Duplicate invoice request (Hunt Form 35) 362
- Economic functions of cost-finding 18
- Emergency
 Component tag (Link-Belt Form 103) 71
- Wheel tag (Link-Belt Form 12, green) 46
- See also* Rush; Urgency
- Employee. *See also* Workman
- Employee's record
 Cottrell Form 40..... 194, 195
- Hunt Form 74..... 406
- Link-Belt Forms 138½, 139 and 167 92, 98
- Wells Form 14..... 296
- Employment record and pay roll—"Scattergood" (Cottrell Form 43) 197
- Employment record—"Scattergood" salary roll and (Cottrell Form 43 B)..... 200
- Engineering and drawing preliminary time record (Hunt Form 14) 346
- Engineer's daily report (Hunt Form 29) 360
- Entering notice—Employee's (Link-Belt Form 139)..... 92
- Entire and partial manufacture... 19
- Envelope
 Departmental communication (Hunt Form 13) 344
- Shop order (Hunt Form 25)..... 357
- Erecting foreman's
 Instructions (Cottrell Form 35, Front) 187
- Report (Cottrell Form 35, Back) 188
- Erection tools list (Link-Belt Form 104) 72
- Erector's expense report (Hunt Forms 68 and 69)..... 401, 402
- Ewart Manufacturing Co..... 29
- Executive engineer (Hunt System Chart No. 4) 329
- Expense report
 Erector's (Hunt Forms 68 and 69) 401, 402
- Traveling salesman's (Cottrell Forms 55 and 55 A)..... 214, 215

Expense statement		Foundry	
Cottrell Form 50.....	206, 208	Cottrell Co.	203
Outside agent's (Hunt Form		Requisition on (Cottrell Form	
9)	341	44)	204
Traveler's (Cottrell Form 36) ..	190	Requisition on (Link - Belt	
Express and freight charges		Form 26)	47
(Hunt Form 86).....	411	Foundry check—Tracing card	
Factory accountant (Hunt Co.)..	412	(Cottrell Form 20).....	176
Factory accounting	12	Foundry clerk—Forge-and- (Cot-	
Factory management—Improved.	17	trell Co.)	166
Factory manager's best informant	16	Foundry material—delivered card	
Factory offices		(Cottrell Form 44).....	204
Cottrell Co.	114	Foundry report—Weekly	
Hunt Co.	317	Brass furnace (Cottrell Form	
Link-Belt Co.	24	47)	205
Potter and Johnston.....	235	Iron furnace (Cottrell Form	
Factory organization	2	46)	205
Factory production forms (Hunt		Freight and express charges	
Co.)	351	(Hunt Form 86).....	411
Factory production order—Reg-		Gang time card—Wrought shop	
ular (Link-Belt Form 28)...	49	Day rates (Link-Belt Form 7) ..	44
Factory requisition		Piece rates (Link-Belt Form	
On purchase agent (Hunt Form		79)	61
31)	363	Gang working system (Link-	
On purchase agent (Potter and		Belt)	40
Johnston Form 2).....	243	General organization (Hunt Sys-	
On warehouse (Hunt Form		tem Chart No. 1).....	323
59)	390, 391	Glass desk tops — Tabulation	
Factory routine	1	(Wells Brothers Co.).....	286
Factory—Visibility in the.....	126	Glossary of terms used in Cot-	
Factory—Written records and		trell works	123
messages in	126	Goods being manufactured (Hunt	
Filing—Case system of (Hunt		Forms 48 and 52).....	376, 381
Co.)	342	Goods-received note; informa-	
Filing directions (Hunt Form 3) ..	338	tion wanted (Hunt Form	
Finished stores		40)	368
Box slip (Hunt Form 51).....	381	Goods returned (Cottrell Form	
Cost card (Hunt Form 46)....	374	65)	223
Delivery record (Bigelow		Gunn and Richards.....	233
Form 4)	112	Head—Definition of	124
Receipt (Wells Form 6 A)....	288	Hunt Company—C. W.	317
Requisition (Wells Form 6 B) ..	288	Hunt—C. W.	318
Stock card (Hunt Form 45)...	373	Hunt Manufacturing Co.	317
Fixtures—Tools and (Potter and		Improvement orders (Cottrell	
Johnston)	268	Forms 38 and 39 A)....	192, 193
Foreign shipment record card		Index card	
(Cottrell Co.)	222	Print (Hunt Form 20).....	350
Foremen's punches (Potter and		Storeroom (Link-Belt Form	
Johnston)	264	49)	56
Foreman's requisition (Potter		Information request (Cottrell	
and Johnston Form 17).....	263	Co.)	225
Forge-and-foundry clerk (Cot-		Information wanted; goods re-	
trell Co.)	166	ceived note (Hunt Form 40) ..	368
Forgings list (Potter and John-		Information-wanted tag (Hunt	
ston Form 1 A).....	241	Form 83)	410
Forgings requisition (Cottrell			
Form 16 A).....	149, 166		

- In Process memorandum (Hunt Forms 48 and 52) 376, 380
 Inquiry, — Departmental (Hunt Form 12) 343
 Inquiry tag (Hunt Form 83).... 410
 Inspector's memorandum (Potter and Johnston Forms 15 and 15 C) 261, 262
 Inspector's tag (Hunt Form 58). 389
 Interdependence of manufacturers 14
 Inventory card
 Machine-tool (Wells Form 1). 280
 Stores ledger (Cottrell Form 9) 143
 Inventory sheet (Hunt Form 67). 400
 Invoice payment slip (Wells Form 13) 295
 Invoice request—Duplicate (Hunt Form 35) 362
 Invoice stamps (Cottrell Forms 3 and 3 A)..... 133
 Invoice (Wells Brothers Co.)... 290
 See also Bill of Lading.
 Iron furnace weekly report (Cottrell Form 46) 205
 Jenks, Joseph, Jr. 234
 Job cards (Hunt Forms 75 and 76) 407
 Job clerk (Hunt Co.)..... 356
 Johnston Machine Co. (Potter and) 234
 Journal leaf (Cottrell Form 67).. 224
 Labor conditions (Cottrell Co.).. 119
 Labor costs 18, 22
 Potter and Johnston Form 26.. 272
 Principal factor of advancement 22
 Labor products—States and nations are 19
 Lathe—Inspector's memorandum for double-turret manufacturing (Potter and Johnston Form 15 C)..... 262
 Lauer, Conrad N. (Link-Belt Co.) 34
 Leaving record — Employees' (Link-Belt Form 138½)..... 92
 Ledger card
 Pattern record (Hunt Form 42) 370
 Rope (Hunt Form R C)..... 336
 Rough and finished stock (Hunt Forms 43, 44, 45 and 46) 371, 374
 Stores or inventory (Cottrell Form 9) 143
 Ledge card
 Stores (Wells Form 12)..... 294
 Ledger — Loose-leaf (Cottrell Form 49) 207
 Lewis—J. Slater 319
 Link-Belt Co.'s buildings (Plan). 25
 Link-Belt Co.'s photograph and blue print department (Plan) 26
 Link-Belt cost system 31
 Link-Belt Engineering Company. 24, 42
 Link-Belt Forms 42
 List
 Castings (Cottrell Form 11 A). 128, 147, 148
 Castings (Cottrell Form 21).. 179
 Castings (Potter and Johnston Form 1) 239
 Department authorities and addresses (Hunt Forms 7 and 13) 340, 344
 Forgings (Potter and Johnston Form 1 A)..... 241
 Parts (Cottrell Form 11 A)... 128, 147, 148
 Tracing sheet (Potter and Johnston) 238
 Loose - leaf accounting forms (Cottrell Co.) 206, 212, 224
 Machine shop
 Daily time card (Bigelow Co.) 107
 Day book (Bigelow Co.)..... 112
 Order for castings and forgings (Cottrell Form 16 A) .. 149, 166
 Potter and Johnston 236
 Production routine (Cottrell Co.) 147
 Machine-tool inventory card (Wells Form 1)..... 280
 Manager's best informant—Factory 16
 Manufacture—Entire and partial. 19
 Manufacturers—Interdependence of 14
 Manufacturers should exhibit their practice 15
 Marks for tool steel..... 293
 Master ticket (Wells Form 16). 300, 301
 Material — Bill of (Link-Belt Form 106) 32, 76, 77
 Material-delivered card (Cottrell Form 11) 146
 Material-ordered box slip (Hunt Form 50) 380
 Materials - purchased records (Link-Belt) 37

- Material-received card (Cottrell Form 4 C)..... 136
- Material received—Certification for (Potter and Johnston Form 3) 244
- Material-returned card (Cottrell Form 8) 142
- Mechanical aids (Cottrell Co.).. 118
- Memorandum
 In process (Hunt Forms 48 and 52) 375, 380
- Merchandise credit (Link-Belt Form 43) 54
- Order (Hunt Forms 47 and 50) 375, 380
- Publication department (Hunt Form 65) 398
- Wells Form 18..... 306
- Merchandise credit—Memorandum for (Link-Belt Form 43). 54
- Minor-order and repairs-order tracing sheet (Cottrell Form 19 C) 174, 175
- Minor-production order
 Potter and Johnston Forms 13 and 14 257, 259
- Wells Form 20..... 308
- See also* Repairs order; Sub-production order
- Miscellaneous bill of material (Hunt Form 22)..... 354, 355
- Miscellaneous forms (Cottrell Co.) 220
- Miscellaneous time card (Link-Belt Form 4) 44, 45
- Nations are labor products—
 States and 19
- Natural values 18
- Night pass (Link-Belt Form 97). 69
- Night watchman (Potter and Johnston) 237
- Notification
 Customer of acceptance of order (Hunt Form 54 A)... 284
- Piece-rate (Link-Belt Form 105) 73
- Shipment (Link-Belt Form 89) 67
- Office
 Cottrell Co..... 114
- Hunt Co. 317
- Link-Belt Co. 24
- Potter and Johnston..... 235
- Office order (Link-Belt Form 81) 62
- Office order record (Wells Form 22) 310
- Officials
 Cottrell Co. 116
- Officials
 Hunt Co. System Chart No. 1. 323
- Potter and Johnston..... 236
- Wells Brothers Co. 275
- Order
 Castings and forgings (Cottrell Form 16 A)..... 149, 166
- Department on storeroom (Link-Belt Form 47) 55
- Purchase agent's (Wells Form 8) 291
- Shop (Potter and Johnston Form 13) 257
- Typewritten production (Bigelow Co.) 102
- Wells Form 19 307
- Order card (Hunt Form 70).... 403
- Order clerk (Hunt Co.) 414
- Order cost sheet
 Link-Belt obsolete Form 32..33, 52
- Link-Belt obsolete Form 111.34, 83
- Order envelope (Hunt Form 25). 357
- Order memorandum
 Cottrell Form 34..... 186
- Hunt Forms 47 and 50..... 375, 380
- Order record book (Cottrell Co.) 188
- Order superintendent (Hunt Co.) 414
- Order tracer (Link Belt Form 53) 58
- Organization
 Factory 2
- Hunt System Chart No. 1..... 323
- Wells Brothers Co. 275
- Outside agent
 Expense statement (Hunt Form 9) 341
- Report (Hunt Form 8)..... 340
- See also* Erector; Salesman; Traveler
- Outside erecting foreman
 Instructions (Cottrell Form 35, Front) 187
- Report (Cottrell Form 35, Back) 188
- Outside expenses
 Record (Hunt Form 82)..... 409
- Requisition (Hunt Form 84).. 410
- Outside pay roll (Link-Belt Form 112) 84
- Outside time card
 Bigelow Form 3..... 108, 109
- Cottrell Form 37..... 191
- Outside time sheet
 Hunt Form 72..... 404
- Hunt Form 82..... 409
- Link-Belt Form 84..... 64
- Outside use—Tag for (Link-Belt Form 15) 46

Outside work		Pay roll time card (Potter and Johnston Forms 4 and 4 A) .	246
Cottrell Co.	187	Pay ticket—Time and (Wells Form 27)	315
Hunt Co.	399	Petty-cash	
Outside workman's time and expense record (Hunt Form 82)	409	Disbursements (Potter and Johnston)	268
Outside-work time voucher (Hunt Form 72).....	404	Requisition (Hunt Form 84)..	410
Package contents list (Hunt Forms 66 and 85)	399, 411	Photograph and blue-print department — Link-Belt Co.'s (Plan)	26
Pad—Copying (Hunt Co.)....	416	Photograph department requisition (Link-Belt Form 123)..	88
Partial manufacture—Entire and	19	Piece-price record (Wells Form 15)	297
Pass—Night (Link-Belt Form 97)	69	Piece-rate cards	
Pattern and casting bill of material (Hunt Form 23).....	353	Cottrell Co.	213
Pattern cost book (Link-Belt Form B)	99	Cottrell Form 56	217
Pattern—Disposition of	194	Link-Belt	39
Pattern order costs (Link-Belt Form B)	99	Potter and Johnston Form 7..	250, 251
Pattern order (Link-Belt Form 1)	43	Revision (Cottrell Form 57)..	217
Pattern receipt postal cards (Hunt Form 28)	359	Wheel (Link-Belt Form 59)..	59
Pattern record		Piece-rate contract with workmen—Wrought-Shop (Link-Belt Form 87)	65
Hunt Form 42.....	370	Piece-rate notification (Link-Belt Form 105)	73
Wells Forms 24 and 25....	311, 312	Piece-work report (Potter and Johnston Form 19).....	269
Pattern return postal card (Form 26)	358	Piece work—Workman's time record at (Potter and Johnston Form 7).....	250, 251
Pattern shipment notification (Hunt Form 27)	359	Piece tag (Hunt Form 24).....	356
Pattern tracing card (Link-Belt Form 52)	57	Plant betterment (Cottrell Co.) .	191
Pattern wanted (Link - Belt Form 153)	94	Plant-betterment order	
Pay envelope (Link-Belt Form 121)	87	Cost record for (Cottrell Form 39 A, Back)	193
Payment slip—Invoice (Wells Form 13)	295	Cottrell Forms 38 and 39 A....	192, 193
Pay receipt (Wells Form 18)...	306	Plat	
Pay roll		Cottrell Co.'s works.....	115
Bills and specie specification and list for (Cottrell Forms 43 D and 43 E).....	202	Link-Belt Co.'s works.....	25
Cottrell Co.....	196, 202	Position cards (Hunt Forms 42, 43, 44, 45 and 46).....	370, 374
Link-Belt Form A.....	96, 97	Postal card	
Outside (Link-Belt Form 112)	84	Notification of pattern shipment (Hunt Form 27).....	359
"Scattergood" (Cottrell Forms 43, 43 A, 43 B and 43 C)...	197, 198, 200, 201	Order for return of patterns (Hunt Form 26).....	358
Workmen and (Potter and Johnston)	245	Receipt of pattern (Hunt Form 28)	359
Pay-roll distribution		Postponed matters (Hunt Form 11)	343
Departmental (Potter and Johnston Form 26).....	272	Potter and Johnston factory....	235
Link-Belt Form 138.....	90, 91	Potter and Johnston Machine Co.	234
		Potter and Johnston product....	235
		Preliminary-drawing index card (Hunt Form 15).....	347

- Preliminary engineer (Hunt System Chart No. 3)..... 328
- Preliminary engineering and drawing time sheet (Hunt Form 14) 346
- Presses ordered in foundry (Cottrell Form A)..... 229
- Presses ordered into shop (Cottrell Form B)..... 231
- Press order memorandum (Cottrell Form 34)..... 186
- Press order record book (Cottrell Co.) 188
- Press sales sheet (Cottrell Form 51) 209
- Principal order
- Castings list for one (Cottrell Form 21) 179
- Placing in work (Cottrell Co.)..... 127
- Specification (Cottrell Form 34) 186
- Tracing and locating (Cottrell Form 14) 156
- See also* Production order
- Principal-order component
- Costs (Cottrell Form 14 A)... 157
- List of castings (Cottrell Form 11 A) 128, 147, 148
- Principal production—Card record of (Cottrell Form 54)... 212
- Principal, S. K. and R. production orders (Cottrell Co.) 144
- Print. *See also* Blue print
- Print dating stamp (Hunt Form 21) 351
- Print index card (Hunt Form 20) 350
- Printing press. *See also* Press
- Printing-press manufacture (Cottrell Co.) 113
- Production forms — Factory (Hunt Co.) 351
- Production order
- Cottrell 127
- Departmental correspondence, used as a (Cottrell Form 10) 145
- Potter and Johnston Form 24.. 270
- Principal, S. K. and R (Cottrell Co.) 144
- Regular factory (Link-Belt Form 28) 49
- Sheet Showing delivery to works on (Bigelow Form 4) 112
- S. K. (Cottrell Co.)..... 152
- Special (Wells Form 26)..... 313
- Superintendent's (Wells Form 5) 284
- Production order
- Tracers (Cottrell Forms 12, 12 A, 12 B and 12 C)..... 159, 152, 153
- Tracers (Cottrell Forms 16, 16 A, 17 and 20)..... 149, 152, 159, 166, 167, 176
- Tracing sheet for components (Potter and Johnston Form 5) 247
- Typewritten (Bigelow Co.) ... 102
- Wells Forms 16 and 17..... 300, 301, 302, 303
- See also* Principal order
- Production-order clerk
- Cottrell Co. 150
- Wells Brothers Co. 285
- Production-order routine (Wells Brothers Co.) 298
- Production routine
- Machine Shop (Cottrell Co.).. 147
- Wells Brothers Co. 276
- Product—Potter and Johnston... 235
- Progress records (Cottrell Co.).. 227
- Publication cuts (Hunt Forms 61 and 61)..... 396
- Publication department (Hunt Co.) 395
- Publication - department memorandum (Hunt Form 65)... 398
- Publication-stores card (Hunt Form 63) 397
- Publicity 12, 15
- Punches—Foremen's (Potter and Johnston) 264
- Purchase agent
- Factory requisition on (Hunt Form 31) 363
- Factory requisition on (Potter and Johnston Form 2)..... 243
- Hunt Co. 414
- Order (Wells Form 8)..... 291
- Quotation card (Cottrell Form 1) 131
- Quotation card (Hunt Form 30) 361
- Purchase order
- Cottrell Form 4..... 134, 135
- Hunt Forms 32 and 33..... 361, 364
- Link-Belt Form 107..... 78, 79, 80
- Rubber hand stamps (Hunt Form 34) 361
- Superintendent's (Wells Form 7) 289
- Purchase records (Link-Belt)... 37
- Purchase requisition — Departmental (Cottrell Form 2)... 132
- Purchase routine
- Cottrell Co. 130

- Purchase routine
 Potter and Johnston..... 253
 Purchase voucher
 Cottrell Form 6..... 139
 Potter and Johnston Form 11.
 254, 255
 Remittance slip (Cottrell Form
 6 A)..... 140
- Quotation
 Hunt Form 5..... 339
 Potter and Johnston Form 23.. 269
 Wells Form 2..... 281
- Quotation card—purchase agent's
 Cottrell Form 1..... 131
 Hunt Form 30..... 361
- Raw materials18, 20
- Reading-notice record (Hunt
 Form 64 B)..... 398
- Ready-for-shipment card (Bige-
 low Co.) 111
- Reamer manufacture 274
- Receipt
 Finished stores (Wells Form
 6 A) 288
 Materials (Potter and John-
 ston Form 3)..... 244
 Pay (Wells Form 18)..... 306
 Rough stores (Wells Form 11)
 292
 Storeroom (Link-Belt Form
 99) 70
 Stores (Hunt Form 38)..... 366
- Record forms (Cottrell Co.) 227
- Records and messages in the fac-
 tory—Objections to the use of
 written 126
- Red-line S. K. components (Cot-
 trell Co.) 151
- Regular factory production order
 (Link-Belt Form 28)..... 49
- Rejected stores note (Hunt Form
 39) 367
- Remittance slip—Purchase vouch-
 er (Cottrell Form 6 A)..... 140
- Renold silent chain..... 29
- Repairs and minor-production or-
 der
 Potter and Johnston Form 14.. 259
 Tracing sheet (Cottrell Form
 19 C) 175
- Repairs and minor productions
 (Cottrell Co.) 168
- Repairs order
 Cottrell Co. 144
 Cottrell Forms 19 and 19 B,
 Back171, 172
 Potter and Johnston Forms 13
 and 14257, 259
- Repairs order
See also Minor-production or-
 der; Sub-production order
- Reply postal cards (Hunt forms
 26, 27 and 28)358, 359
- Report
 Accident (Link-Belt Form 117)
 85, 86
 Damage (Link-Belt Form 27).. 48
 Outside agent (Hunt Form 8). 340
 Tool-room (Link-Belt Form
 31) 51
 Watchman's (Link-Belt Form
 42) 53
- Requisition
 Blue prints (Hunt Form 18).. 349
 Castings and forgings (Cottrell
 Form 16 A).....149, 166
 Drawing - room (Link - Belt
 Form 124) 87
 Finished stores (Wells Form
 6 B) 288
 Foreman's (Potter and John-
 ston Form 17)..... 263
 Foundry (Cottrell Form 44)... 204
 Foundry (Link-Belt Form 26). 47
 Link-Belt Form 61..... 60
 Petty cash and outside expenses
 (Hunt Form 84)..... 410
 Photograph department (Link-
 Belt Form 123)..... 88
 Publication department (Hunt
 Form 60) 395
 Purchase agent (Hunt Form
 31) 363
 Purchase agent (Potter and
 Johnston Form 2)..... 243
 Stock (Wells Forms 6 B and
 7)288, 289
 Storekeeper's (Wells Form 6). 288
 Stores replenishment (Cottrell
 Form 15) 158
 Warehouse (Hunt Form 59)..
 390, 391
- Returned goods
 Cottrell Form 65..... 223
 Wells Form 23..... 310
- Returned-material card (Cottrell
 Form 8) 142
- Richards—Gunn and 233
- Rivets (Bigelow Co.).....101, 111
- Rope forms (Hunt Co.)..... 334
- Rope ledger card (Hunt Form
 R C) 336
- Rope Keeper (Hunt Co.)..... 332
- Rope shipping order (Hunt Form
 R. A) 335
- Rope tag envelope (Hunt Form
 R B) 336

- Rough-stores
 Cost card (Hunt Form 44).... 372
 Receipt (Wells Form 11)..... 292
 Room (Wells Bros. Co.)..... 292
 Stock card (Hunt Form 43).. 371
 Route list—Traveling salesman's
 (Cottrell Form 55).....214, 215
 Routine
 Factory I
 Machine-shop production (Cottrell Co.) 147
 Production (Wells Bros. Co.).. 276
 Purchase (Cottrell Co.)..... 130
 Purchase (Potter and Johnston) 253
 Stores (Wells Bros. Co.)..... 287
 Rubber stamp
 Correspondence (Cottrell Forms 33, 33 A and 33 B).. 183, 184, 185
 Invoice (Cottrell Forms 3 and 3 A) 133
 Master ticket (Wells Form 16) 299, 300
 Print (Hunt Form 21)..... 351
 Rules for workmen (Cottrell Co.) 119
 Rush order
 Wells Form 21..... 309
 Wheel tag (Link-Belt Form 12) 46
See also Emergency; Urgency
 Salary rolls
 Cottrell Co.196- 202
 "Scattergood" (Cottrell Forms 43 B and 43 C).....200, 201
 Sales and expense statement—
 Traveling salesman's yearly
 (Cottrell Form 55 A)..... 216
 Sales department (Hunt System Chart No. 2)..... 327
 Sales forms (Hunt Co.)..... 382
 Salesman, *See also* Outside Agent; Traveler
 Salesmen's report and route list
 (Cottrell Form 55).....214, 215
 Salesmen's report (Hunt Form 73) 405
 Salesmen—Traveling
 Wells Brothers Co..... 283
See also Traveler
 Sales orders and shipments
 (Wells Brothers Co.)..... 283
 Sales orders (Hunt Forms 54, 54 A, 54 B, 54 C, 54 D, 54 E, 55, 56 and 57).....383, 392
 Sales record (Wells Form 4).... 282
 Sales requisition on warehouse
 (Hunt Forms 56 and 57).... 388, 392
 Salesroom (Wells Brothers Co.) 278
 Sales sheet (Cottrell Form 51).. 209
 "Scattergood" pay rolls (Cottrell Forms 43, 43 A, 43 B and 43 C)197, 198, 200, 201
 Screws, bolts and steel bars box
 (Hunt Form 53)..... 381
 Second-hand press specification
 (Cottrell Form 59)..... 219
 Secrecy12, 15
 Sheet showing delivery to works
 on production orders (Bigelow Form 4)..... 112
 Shipment card (Bigelow Co.)... 111
 Shipment notification
 Cottrell Co.....220, 221
 Link-Belt Form 89..... 67
 Shipment record cards—Domestic
 and foreign (Cottrell Form 64)221, 222
 Shipments — Sales orders and
 (Wells Brothers Co.)..... 278
 Shipper's report (Link-Belt Form 28) 49
 Shipping clerk—Directions for
 (Cottrell Form 60)..... 221
 Shipping marks (Cottrell Form 60) 221
 Shipping order — Rope (Hunt Form R A)..... 335
 Shipping ticket (Link-Belt Form 110)81, 82
 Shop order
 Hunt Form 70..... 403
 Minor production (Potter and Johnston Form 13)..... 257
 Wells Forms 17 and 20,302, 303, 308
 Shop-order case (Wells Brothers Co.) 305
 Shop - order envelope (Hunt Form 25) 357
 Shops, workmen and labor conditions (Cottrell Co.) 119
 Short operations—Time card for
 (Cottrell Form 31) 181
 Shrinkage of orders (Wells Brothers Co.) 275
 Silent - chain - wheel cost card
 (Link-Belt Form 155)..... 95
 Simple aids preferred to fewer
 complex forms—Many 17
 Single-operation order (Wells Form 19) 307
 S. K. components (Cottrell Co.)127, 151, 152

S. K. production order (Cottrell Co.)	152	Stores-received note (Hunt Form 38)	366
S. K. tracer (Cottrell Form 17)	167	Stores receiving and disbursement (Link-Belt)	29
Smith system—Beaman and	285	Stores-rejected note (Hunt Form 39)	367
Snow, F. E. (Wells Brothers Co.)	276	Stores - replenishment requisition (Cottrell Form 15)	158
Sorting Box—Time card (Cottrell Co.)	182	Stores requisition—General departmental (Cottrell Form 11)	146
Specialized factor	20	Stores routine (Wells Brothers Co.)	287
Special-production order (Wells Form 26)	313	Stores wanted (Wells Form 6) ..	288
Special work (Wells Brothers Co.)	275	Subordinates—Choice of	3
Specie and bills, specification and list for pay roll (Cottrell Forms 43 D and 43 E)....	202	Sub-plant order (Cottrell Form 38)	192
Statement		Sub-production order	
Cottrell Co.	225	Cottrell Co.	152
Potter and Johnston	271	Wells Form 20	308
States and nations are labor products	19	<i>See also</i> Minor-production order; Repairs order	
Stationery		Subscription record (Hunt Form 64 C)	398
Record (Hunt Form 63)....	397	Superintendent's production order (Wells Form 5)	284
Requisition (Hunt Form 60) ..	395	Superintendent's purchase order (Wells Form 7)	289
Steel bars, screws and bolts box slip (Hunt Form 53)	381	Superintendent — Works (Hunt System Chart No. 5)	330
Stevodore rope (Hunt Co.).....	332	Supplies urgently required (Hunt Form 36)	365
Stock card		Supply order—Workmen's (Hunt Form 79)	408
Rough stores (Hunt Form 43) ..	371	System charts (Hunt Co.)	320
Finished stores (Hunt Form 45)	373	Tabulation, desk tops (Wells Brothers Co.)	286
Stock production orders (Cottrell Co.)	144, 152	Tag	
Stock received (Wells Forms 6 A and 11)	288, 292	Color scheme of component (Link-Belt)	30
Stock replenishment (Cottrell Co.)	127, 151, 152	Component (Link-Belt Form 103)	71, 72, 74
Storekeeper (Hunt Co.)	394	Inspectors (Hunt Form 58) ..	389
Storekeeper's requisition (Wells Form 6)	288	Outside use (Link-Belt Form 15)	46
Storeroom (Cottrell Co.)	126	Piece (Hunt Form 24)	356
Storeroom—Department order on (Link Belt Form 47)	55	Questionable material (Hunt Form 83)	410
Storeroom index card (Link-Belt Form 49)	56	Wheel (Link-Belt Form 12) ..	45, 46
Storeroom receipt (Link-Belt Form 99)	70	Tag envelope for rope (Hunt Form R B)	336
Stores-delivered book (Bigelow Co.)	103	Taine (Quotation from)	1
Stores-delivery record (Bigelow Form 4)	112	Tap manufacture	274
Stores - in - progress box slip (Hunt Form 52)	380	Taylor, Fred. W. (Link-Belt system)	31
Stores ledger card		Telegraph and telephone order record (Wells Form 22) ..	310
Cottrell Form 9	143		
Wells Form 12	294		
Stores (Link-Belt)	29		
Stores marks	293		

- Telephone message record (Hunt Form 2) 338
 Terms used in the Cottrell Works—Glossary of 123
 Time and pay ticket (Wells Form 27) 315
 Time card
 Cottrell Co 178, 180
 Drawing - room (Link - Belt Form 152) 93
 Hunt Forms 77 and 78 407
 Link-Belt 39
 Machine shop daily (Bigelow Co.) 107
 Miscellaneous (Link-Belt Form 4) 44, 45
 Outside (Bigelow Form 3) 108, 109
 Outside (Cottrell Form 37) .. 191
 Potter and Johnston Forms 4 and 4 A 246
 Short operations (Cottrell Form 31) 181
 Unproductive labor (Cottrell Form 32) 183
 Wheel (Link-Belt Form 59) .. 59
 Wrought shop gang, day rates, (Link-Belt Form 7) 44
 Wrought shop gang, piece rates (Link-Belt Form 79) 61
 See also Day rates; Piece rates; Time sheet; Wages; Workman's time record
 Time-card sorting box (Cottrell Co.) 182
 Time record
 Day record (Potter and Johnston Form 6) 249
 Piece rate (Potter and Johnston Form 7) 250, 251
 Time recorder card (Potter and Johnston Forms 4 and 4 A) 246
 Time recorder (Cottrell Co) 120
 Time sheet
 Bigelow Form 2 105, 106
 Outside (Hunt Forms 72 and 82) 404, 409
 Outside (Link-Belt Form 84) .. 64
 See also Time card
 Tioga Foundry 50
 Tool and fixtures (Potter and Johnston) 268
 Tool list—Erection (Link-Belt Form 104) 72
 Tool record—Workman's (Potter and Johnston Form 18) .. 265
 Tool-room charge sheet (Bigelow Form 1) 104
 Tool room (Potter and Johnston) 266
 Tool room report (Link-Belt Form 31) 51
 Tool-steel bars identification .. 293
 Tracer and master ticket (Wells Form 16) 300, 301
 Tracer—Order (Link-Belt Form 53) 58
 Tracers and production orders
 See Transfer cards
 Tracing and locating form—Principal order (Cottrell Form 14) 156
 Tracing card
 Foundry check (Cottrell Form 20) 176
 Pattern (Link-Belt Form 52) 57
 Tracing—Component (Cottrell Co.) 120
 Tracing scheme (Cottrell Co.) .. 162
 Tracing sheet and list (Potter and Johnston) 238
 Tracing sheet for components—Production order and (Potter and Johnston Form 5) 247
 Tracing sheet—Minor order and repairs order (Cottrell Form 19 C) 174, 175
 Transfer cards and production orders
 Cottrell Forms 12, 12 A, 12 B and 12 C..... 150, 152, 153
 Cottrell Forms 16, 16 A, 17 and 20 .. 149, 152, 159, 166, 167, 176
 Transfer clerk (Cottrell Co.) .. 160
 Traveler
 Expense statement (Cottrell Form 36) 190
 Forms (Hunt Co.) 337
 Letter sheet (Hunt Form 4) .. 338
 Report (Hunt Form 8) 340
 See also Outside agent; Salesman; Traveling salesman
 Traveling expense memorandum (Potter and Johnston Form 8) 252
 Traveling expenses (Hunt Form 9) 341
 Traveling salesmen
 Reports (Cottrell Co.) 213
 Weekly expense report and route list (Cottrell Form 55) 214, 215
 Wells Brothers Co. 283
 Traveling salesmen
 Yearly sales and expense statement (Cottrell Form 55 A) 216
 See also Outside agent; Salesman; Traveler

- Trays for cards (Cottrell Co.)... 122, 125, 161
- Truck call notification to supplier (Hunt Form 37) 362
- Truck will call (Hunt Form 34) 362
- Typewritten production order (Bigelow Co.) 102
- Unproductive labor—Time card for (Cottrell Form 32) .. 183
- Urgency. *See also* Emergency; Rush
- Urgency Note—Suppliers' (Hunt Form 36) 365
- Vertical filing (Wells Brothers Co.) 280
- Vise—Definition of 125
- Visibility in the factory 126
- Visitors' card. *See* Callers' Slip
- Vivify—Definition of 125
- Voucher
- Purchase (Cottrell Form 6) 139
- Purchase (Potter and Johnston Form 11) 254, 255
- Purchase remittance slip (Cottrell Form 6 A) 140
- Record (Cottrell Form 5) 137
- Record book (Potter and Johnston) 253, 257
- Wages
- Change in day rate (Cottrell Form 41) 195
- Claim slip for errors (Cottrell Form 42) 196
- Daily cost sheet (Link-Belt Form 130) 36, 89
- Time records (Potter and Johnston) 248, 251
- See also* Day rates; Piece rates; Time cards; Workman's time record
- Waiting tray (Cottrell Co.) .. 125
- Wanted
- Pattern (Link-Belt Form 153) 94
- Stores (Wells Form 6) 288
- Warehouseman (Hunt Co.) .. 392
- Warehouseman's particulars of delivery (Hunt Form 55) .. 387
- Warehouse — Requisition on (Hunt Forms 56, 57 and 59) 388, 392
- Waster report (Cottrell Form 13) 154
- Watchman—Night (Potter and Johnston) 237
- Watchman's report (Link-Belt Form 42) 53
- Weekly foundry report
- Brass (Cottrell Form 47).... 205
- Iron (Cottrell Form 46)..... 205
- Weekly pay rolls—"Scattergood" (Cottrell Forms 43 A and 43 C).....198, 201
- Weekly report of traveling salesmen (Cottrell Form 55) 214, 215
- Weekly time and production record (Wells Form 27) 315
- Weekly time card for outside workmen (Cottrell Form 37) 191
- Wells Brothers Co 274
- Wells, F. O. 275
- Wheel card index (Link-Belt Form 83) 63
- Wheel cost card—Silent-Chain (Link-Belt Form 155) 95
- Wheel tag (Link-Belt Form 12) 45, 46
- Wheel time card (Link-Belt Form 59) 59
- Wooden case for shop order (Wells Brothers Co.) 305
- Work-in-progress records (Cottrell Forms A and B) 229, 231
- Workman
- Cottrell Co. 119
- Link-Belt 27
- Potter and Johnston 245
- Wells Brothers Co. 278
- See also* Employee
- Workman's record
- See* Employee's record
- Workman's supply record (Hunt Form 79) 408
- Workman's time record
- Day rates (Potter and Johnston Form 6) 249
- Piece rates (Potter and Johnston Form 7) 250, 251
- See also* Piece rates; Time cards; Wages
- Workman's time sheet (Bigelow Form 2) 105, 106
- Workman's tool record (Potter and Johnston Form 18) 265
- Works superintendent (Hunt System Chart No. 5)..... 330
- Wrought-shop gang time card
- See* Time card
- Wrought shop (Link-Belt) 40
- Wrought-shop piece-rate contract with workmen (Link-Belt Form 87) 65
- Yearly sales and expense statement—Traveling salesman's (Cottrell Form 55 A) 216



THE COMPLETE COST-KEEPER

BY THE SAME AUTHOR

SOME ORIGINAL SYSTEMS OF SHOP COST-KEEPING OR FACTORY ACCOUNTING

An Exposition of the Advantages of Account-Keeping by Means of Cards instead of Books, and a Description of Various Mechanical Aids to Factory Accounting

THIS book is designed to give such an exhibition of widely differing systems of cost-keeping now in satisfactory use as will afford any manager, although not himself an accountant, the knowledge needful to an intelligent comparison between his own methods and cost-keeping methods in general.

It presents different original cost-keeping systems, varying in complexity from one so simple that the entire history of each production order is recorded on a single printed form, up to some of the most elaborate methods known, by which any desired degree of minuteness in subdivision of accounting can be obtained.

Every step in the use of the several systems is minutely detailed, and when the factory production is separated from the purely commercial operation of disposing of the factory product, the commercial books are also described, and in all cases the number of men at work and the number and class of book-keepers, clerks, messengers, time-takers and so on, employed in cost-accounting is given, so that any manager can tell about what he may expect the use of a similar system to cost in his own establishment.

450 Pages Fully Illustrated. Price, \$5.00, Cloth Binding

THE ENGINEERING MAGAZINE PRESS

120-122 LIBERTY STREET, NEW YORK.

My dear Mr. [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

UNIVERSITY OF CALIFORNIA LIBRARY
BERKELEY

Return to desk from which borrowed.

This book is DUE on the last date stamped below.

NOV 17 1947

RECEIVED

MAR 16 '70 -3 PM

NOV 3 1968 11

LOAN DEPT.

RECEIVED

NOV 03 1995

OCT 21 '68 -5 PM

RECEIVED

LOAN DEPT.

SEP 21 1995

CIRCULATION DEPT.

FEB 18 1970 58

\$ m. gkt
Eso net

U. C. BERKELEY LIBRARIES



C051393280

Arnold

163819
HF5686
.M3A25

